Operations & Service Manual

GS-Series Pinsetter with UK Advanced/Advanced Guarding

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CUSTOMER SERVICE
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GS-Series Pinsetter with UK Advanced/Advanced Guarding Operation and Service Manual

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CONTENTS

Safety Alerts 1-2
Safety Notice to Users of This Manual 1-3
Safety Guidelines for GS-Series Pinsetters 1-4
Pinsetter Status Light / Machine Power on Sequence 1-6
Clearing Pins Jammed in Distributor 1-7
Stopping Machine in Mid-Cycle 1-7
Clearing Error Codes and Correcting Pinsetter Stops 1-8
Machine Guards 1-9

SAFETY ALERTS

Notes & Warnings

Throughout this publication, “Warnings”, and “Cautions” (accompanied by one of the International HAZARD Symbols) are used to alert the mechanic to special instructions concerning a particular service or operation that may be hazardous if performed incorrectly or carelessly. They are defined below. OBSERVE AND READ THEM CAREFULLY!

These “Safety Alerts” alone cannot eliminate the hazards that they signal. Strict compliance to these special instructions when performing the service, plus training and “Common Sense” operation are major accident prevention measures.

NOTE or IMPORTANT!:Will designate significant informational notes.

WARNING! Will designate a mechanical or nonelectrical alert which could potentially cause personal injury or death.

WARNING! Will designate electrical alerts which could potentially cause personal injury or death.

CAUTION! Will designate an alert which could potentially cause product damage.

Will designate grounding alerts.

SAFETY NOTICE TO USERS OF THIS MANUAL

This manual has been written and published by the Service Department of Brunswick Bowling and Billiards to aid the reader when servicing or installing the products described.

It is assumed that these personnel are familiar with, and have been trained in, the servicing or installation procedures of these products, which includes the use of common mechanic's hand tools and any special Brunswick or recommended tools from other suppliers.

We could not possibly know of and advise the reader of all conceivable procedures by which a service might be performed and of the possible hazards and/or results of each method. We have not attempted any such wide evaluation. Therefore, anyone who uses a service procedure and/or tool, which is not recommended by Brunswick, must first completely satisfy himself that neither his nor the products safety will be endangered by the service procedure selected.

All information, illustrations and specifications contained in this manual are based on the latest product information available at the time of publication.

It should be kept in mind, while working on the product, that the electrical system is capable of violent and damaging short circuits or severe electrical shocks. When performing any work where electrical terminals could possibly be grounded or touched by the mechanic, the power to the product must be disconnected prior to servicing and remain disconnected until servicing is complete.

PINSETTERS EQUIPPED WITH SAFETY POWER CONTROLLERS

The GS-X Pinsetter Safety Controller system must be commissioned and serviced only by specialist personnel.

Specialist Personnel

Specialist personnel (Center Mechanics) are defined as persons who:

- have undergone the appropriate technical training and
- who have been instructed by the responsible pinsetter operator in the operation of the pinsetter and the current valid safety guidelines and
- who have access to the "Safety Photoelectric Switch System L 4000" operating instructions.

General Safety Information and Protective Measures

Safety Notes

Please observe the following procedures in order to ensure the correct and safe use of the GS-X Pinsetter Power Controller system.

- The national/international rules and regulations apply to the installation, commissioning, use and periodic technical inspections of the GS-X Pinsetter Safety Controller system, in particular

  - Machine Directive 98/37/EEC
  - Equipment Usage Directive 89/655/EEC
  - the work safety regulations/safety rules
  - other relevant health and safety regulations

- Users of the pinsetter with which the GS-X Pinsetter Safety Controller system is used are responsible for obtaining and observing all applicable safety regulations and rules.

- It is imperative that all test notes created during the Tests performed before the first commissioning and Functional checks of the protective device sections of this manual are observed.

- The tests must be carried out by the center mechanic and must be recorded and documented to ensure that the tests can be reconstructed and retraced at any time.

- The operating instructions must be made available to the user of the pinsetters where GS-X Pinsetter Safety Controller system is used. The pinsetter operator is to be instructed in the use of the device by center mechanic and must be instructed to read the operating instructions.

Tests Performed Before the First Commissioning

The purpose of the tests before the first commissioning is to confirm the safety requirements specified in the national/international rules and regulations, especially in the Machine and Equipment Usage Directive (EU Conformity).

- To ensure correct function, test as defined in the Functional checks of the protective device section.
- The distance between the sender and receiver must not exceed the maximum distance of 7 meters.
- Access to the hazardous point of the pinsetter must only be possible through the protective fields.
- It must not be possible to climb over, creep underneath or pass around the protective devices.
- Make sure that the operating personnel of the pinsetters protected by the GS-X Pinsetter Power Controller system are correctly instructed by specialist personnel before being allowed to operate the pinsetters. Instructing the operating personnel is the responsibility of the machine owner.

Functional Checks of the Protective Devices

The effectiveness of the protective devices must be checked daily, or before work is commenced, by a specialist or by authorized personnel.

Prior to each test verify on the safety evaluation device UE 401 that the green LED illuminates. If this is not the case, make sure that this condition is reached. The tests are otherwise meaningless.

1. Completely cover each light beam with a test piece that is not transparent (at least 30 mm diameter) at the following positions:
   - Directly in front of the sender.
   - In the middle between sender and receiver.
   - Directly in front of the receiver.
2. Open the rear pinsetter access door with the interlock switch.
3. Open the masking unit interlock switch.
4. Press the emergency stop switch.

Each of these individual tests must produce the following result:

- During the light beam test the receiver for the related safety photoelectric safety switch must have no LED illuminated.
- On the safety evaluation device UE 401 only the red LED must illuminate
- As long as the light beam, interlock or emergency stop switch is interrupted, it must not be possible to initiate the dangerous state of the machine.

No further operation of the pinsetter is allowed if the green or yellow LED on the safety evaluation device UE 401 illuminates during the test, even if the green or yellow LED illuminates only for a short period. In this case, the installation of the GS-X Pinsetter Power Controller system must be checked by specialized.

The proper functioning of the interlock devices must be checked weekly, by a specialist or by authorized personnel.

Prior to the tests, turn off and lockout the main power switch on the GS-X Pinsetter Power Controller system.

a. Unplug the rear door interlock cable from the GS-X Pinsetter Power Controller box and verify that when the interlock switch is closed (rear door closed) that there is continuity from pin 1 to 2 and from pin 3 to 4 of the connector. Then verify that when the interlock switch is opened (rear door opened) that there is no continuity from pin 1 to 2 and from pin 3 to 4 of the connector. This should be done with a multi-meter.

b. Unplug the masking unit interlock cable from the GS-X Pinsetter Power Controller box and verify that when the interlock switch is (masking unit down) that there is continuity from pin 1 to 2 and from pin 3 to 4 of the connector. Then verify that when the interlock switch is opened (masking unit up) that there is no continuity from pin 1 to 2 and from pin 3 to 4 of the connector. This should be done with a multi-meter.

c. With the emergency stop switch on the GS-X Pinsetter Power Controller box in the non-pressed position, verify that there is continuity between the two orange wires on the switch and continuity between the two brown wires on the switch. Then with the emergency stop switch on the GS-X Pinsetter Power Controller box in the pressed position, verify that there is no continuity between the two orange wires on the switch and no continuity between the two brown wires on the switch. This should be done with a multi-meter.

Care and Maintenance

The lenses for the sensors must be cleaned regularly or if dirty. Avoid scratching the lenses and the formation of droplets on the lenses as these could change the optical properties.

- Do not use aggressive cleaning agents.
- Do not use abrasive cleaning agents.

Static charges cause dust particles to be attracted to the lens. You can prevent this effect by using the antistatic plastic cleaner (SICK Part No. 5 600 006) and the SICK lens cloth (Part No. 4 003 353).

How to clean the lens:

- Use a clean and soft brush to remove dust from the lens.
- Then wipe the lens with a clean and damp cloth.

After cleaning, check the position of sender and receiver to make sure that it is not possible to climb over, creep below or stand behind the protective device.

SAFETY GUIDELINES FOR GS-SERIES PINSETTERS

As with all machinery, a certain amount of risk is involved in working on the GS-Series Pinsetter. However, if the necessary care, knowledge and responsibility are exercised, damage to the pinsetter and people involved in accidents can be avoided. The following steps should be taken:

1. ONLY PROPERLY TRAINED PEOPLE ARE QUALIFIED TO WORK ON OR OPERATE THE PINSETTER

2. Never operate the pinsetter without ALL factory supplied guarding in place.

3. Never operate the pinsetter if a guard or safety device is damaged or improperly fitted to the machine.

4. Never bypass, disable, or tamper with the safety interlocks or pinsetter function switches.

5. Never attempt to climb over or around any mechanical barrier or machine guard.

6. Reinstall all the machine guards and the ladder after any troubleshooting or maintenance work has been done on the pinsetter(s) or ball accelerator.

7. Always face toward the machine when using the ladder to climb onto or off the machine. Only one person should be on the ladder at any time.

8. Suitable clothing must be worn (for example: rubber-soled shoes). Do not wear loose clothing such as neckties or smocks that could get caught in moving parts. Remove rings, watches, earrings, bracelets and other jewelry to avoid injury.

9. Care should be taken while near the front of the machine. Accidentally blocking the photocell beam with will cause the pinsetter to cycle.

10. Always turn the Pinsetter off before working on the machine. Use the rear mechanic's switch mounted on the pin elevator or toggle the stop/run switch on the Nexgen box to the stop position.

11. If more than one person is working on a machine or if a stop/run switch will be out of reach while working on the machine, turn off both stop/run switches to prevent a person from turning on the pinsetter before the other person says he/she is clear of the pinsetter.

12. When working on both machines of a lane pair or components that are common to both machines (for example - an electronic control box or ball accelerator) power must be turned off at the Nexgen box and the input power cable must be removed from the box. In addition the main power switch on the Nexgen box must be locked into the off position using a suitable locking mechanism.

13. The sweep boards for the lane pair must be dropped to the guarding position when working on the pinsetter or the ball accelerator to prevent a bowling ball from entering the pinsetter.

14. Prior to performing service work underneath the setting table, place a jack stand or other suitable support under the center of the table.

15. Fire extinguishers must be on hand and maintained properly. Keep oily rags and other combustibles in approved fire proof containers.

16. If more than one person is working on a machine, be sure the other person is CLEAR before restarting the machine.

17. When working in the pinsetter area while machines are in operation, ear protection should be worn. Sound levels greater than 83db can be experienced within 1.6 meters of operating machines.

18. Never remove the V-belt from the setting table motor without first lowering the table to the new pin setting position (pindeck).

19. Never work on or around the pinsetter while under the influence of alcohol, drugs, or any other substance that can impair your physical abilities or mental judgment.

20. Always use the correct tools for the job.

21. The GS-Series pinsetter is designed for use as a 10 pin bowling machine. Do not use the machine or any of its subassemblies for any other purpose.

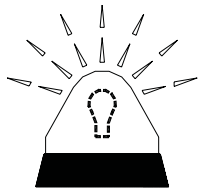
22. Poisonous or toxic cleaners must not be used. Always check the material safety data sheets before using new cleaners.

23. Always use factory approved parts when repairing the pinsetter. Using substandard parts may pose a safety risk.

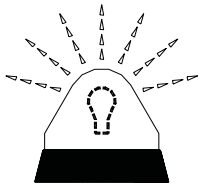
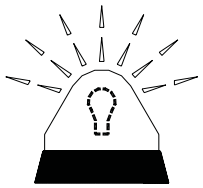
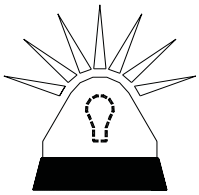
PINSETTER STATUS LIGHT / MACHINE POWER ON SEQUENCE

The red light located on top of the elevator provides the operator with valuable information concerning the state of the machine. The meaning of the light depends on what software version in installed on the Nexgen box's CPU PCB.

Software Version 4.9.08 and prior

	Slow-flashing red light indicates an error has occurred. The pinsetter needs attention. Turn machine off and lock out power before servicing.
	No light indicates the pinsetter may be READY TO RUN. A signal from a remote location will cause the pinsetter to start WITHOUT WARNING. Stay clear of machine. Turn off the Stop/Run switch before servicing.

Software Version 4.9.09 and later:

	Rapid-flashing red light indicates the pinsetter is GETTING READY TO RUN. Stay clear of machine & keep guards in place
	Slow-flashing red light indicates an error has occurred. The pinsetter needs attention. Turn machine off and lock out power before servicing.
	Solid red light indicates the pinsetter is READY TO RUN. A signal from a remote location will cause the pinsetter to start WITHOUT WARNING. Stay clear of machine. Keep guards in place.
	No light indicates the pinsetter is off. Safe to Service. Lock out power before servicing

NOTE: The light's function is selectable in Nexgen boxes with firmware version 4.95.21 or higher.

CLEARING PINS JAMMED IN DISTRIBUTOR

1. Turn the stop/run on the mechanic's remote display or the Nexgen box, to the stop position. Turn off the main power switch on the Power Safety Controller box and lock the switch into the off position using an approved lockout device.

2. Check for pins jammed at track ejector points. Check for pins jammed at belt turning points. Remove the jammed pins and place them on the outside return belt track.

3. Check the pin ejector assemblies for proper positions.

4. Continuous jams require checking the pin station assemblies for broken parts or missing pin release levers.

5. Re-install all guards and restart the safety controller restore power to the pinsetter::

   Version I or version II Safety Controller (SICK) - Press the restart switch on the Safety Controller box to restore power to the Nexgen box.

   Version III Safety Controller (Pilz) - If the Green "Restart Photocell" LED is "On" press the photo sensor restart button to illuminate the yellow "Ready for Restart" LED, then press the restart button. If only the yellow "Ready for Restart" LED in "On" press the restart button.

6. Once the machine has initialized, toggling the stop/run switches on the mechanic's remote display to clear the power failure (PF) codes.

7. Check pinsetter operation.

STOPPING MACHINE IN MID-CYCLE

A machine may be stopped in mid-cycle by turning the stop/run switch on the Nexgen Controller or mechanic's remote display to the stop position. Once power is restored to the pinsetter it will automatically return to home or ready to bowl position.

If internal service work is to be performed, turn off the main power switch on the Power Safety Controller and lock the switch in the off position using an approved lockout device to prohibit the machine from being turned on

NOTE: Removing the incoming 3 phase power will disable both pinsetters. Upon completion of work, remove any installed lockout devices and turn the main power switch on. Restore power to the Nexgen box by pressing the restart button on the Safety Controller.

Once the machine has initialized, clear the power failure (PF) error code by toggling both stop/run switches off then on.

CLEARING ERROR CODES AND CORRECTING PINSETTER STOPS

When a pinsetter experiences a stop, the Nexgen CPU, will shut down the machine and flash the red status light located on top of the elevator assembly. A code indicating the problem encountered will be shown on the display of the Nexgen box or the remote display terminal.

NOTE: Some errors or problems with the pinsetter may not be detected by the Pinsetter CPU. Examples are ball accelerator problems or scoring errors. In these situations the status light will not flash to indicate a problem.

The following procedure should be used for correcting pinsetter stops or malfunctions.

1. When approaching the pinsetter from the rear, turn the stop/run switch located on the mechanic's remote display terminal to the stop position. When approaching the pinsetter from the front, power to the Nexgen box will automatically be disconnected when the masking unit is lifted or the safety photo sensor in front of the machines is blocked, or the rear access door is opened.

2. Determine the reason for the stop. Look for pins on shark switch assembly, distributor, or on top of the setting table. If the status light is flashing look at the display located on the top of the remote display terminal for an associated error code.

3. Clear the jam, repair or replace the failed part, or make the adjustment as appropriate. If making the correction requires work to be done on the pindeck, ball accelerator, or pit area, lower the sweep wagon to prevent a ball from entering the machine.

4. Re-install all guards and verify all interlock and sensors are in their proper position.

5. Restart the Safety Controller:

   Version I or version II Safety Controller (SICK) - Press the restart switch on the Safety Controller box to restore power to the Nexgen box.

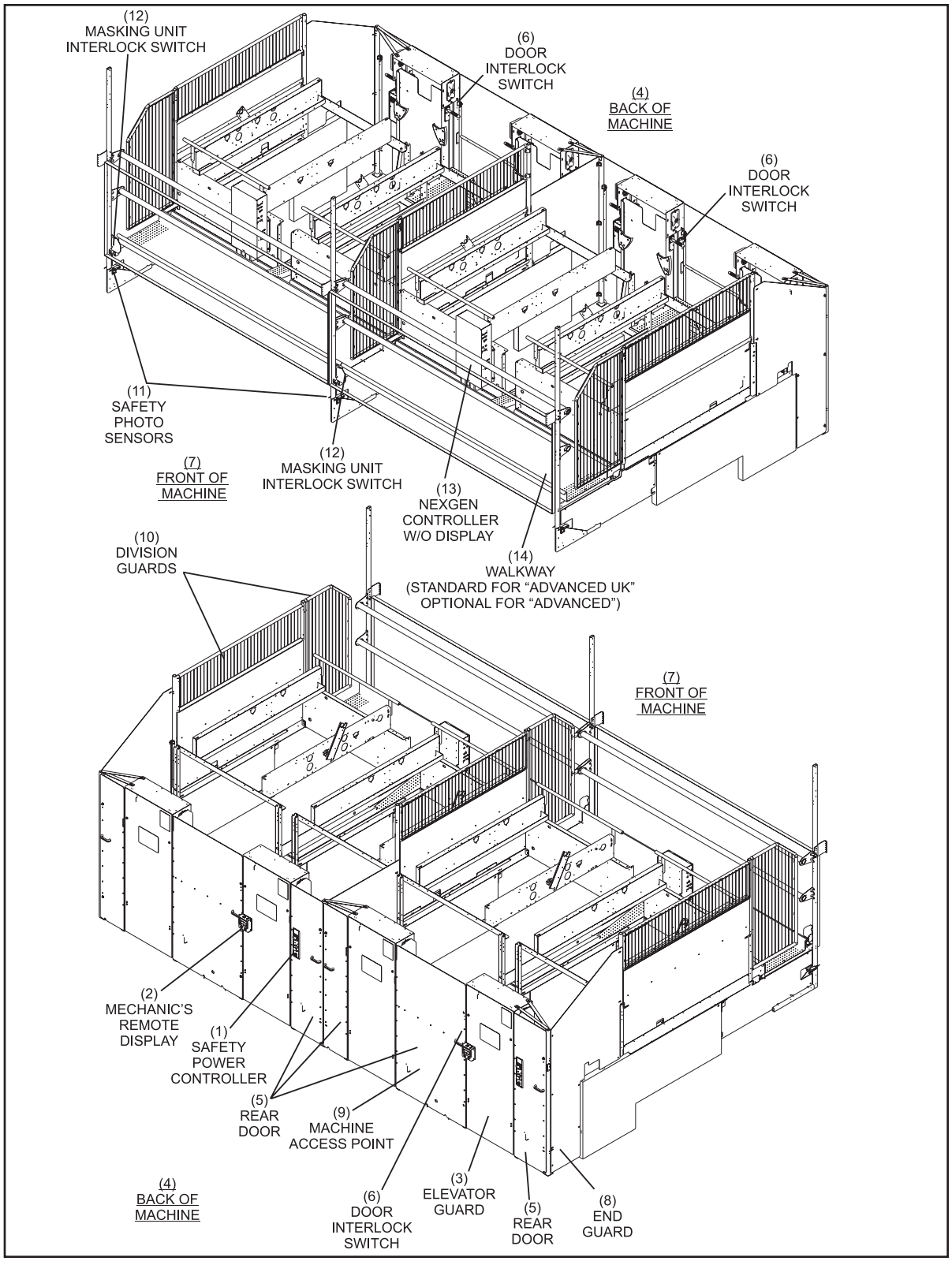
   Version III Safety Controller (Pilz) - If the Green "Restart Photocell" LED is "On" press the photo sensor restart button to illuminate the yellow "Ready for Restart" LED, then press the restart button. If only the yellow "Ready for Restart" LED in "On" press the restart button.

6. Once the machine has initialized, toggle the STOP/RUN switches for each machine off/on to clear the power failure (PF) code.

7. If the machine will not restart, recheck the error code diagnostic display. If an invalid state is displayed, you must return the table (up) or sweep (forward) to its home position.

MACHINE GUARDS

The GS Pinsetter is equipped with guards and safety interlocks to prevent injury and to limit access to moving parts of the pinsetter. Two types of guard packages are available; advanced and advanced - UK. The two packages are very similar to each other. The difference is that the U.K. version contains the walkway as a standard required component. Also additional division guarding is added to the machines to provide greater protection. Refer to figure titled Advanced Guard Packages.



Advanced Guard Packages

(1) SAFETY POWER CONTROLLER
(2) MECHANIC'S REMOTE DISPLAY
(3) ELEVATOR GUARD
(4) BACK OF MACHINE
(5) REAR DOOR
(6) DOOR INTERLOCK SWITCH
(7) FRONT OF MACHINE
(8) END GUARD
(9) MACHINE ACCESS POINT
(10) DIVISION GUARDS
(11) SAFETY PHOTO SENSORS
(12) MASKING UNIT INTERLOCK SWITCH
(13) NEXGEN CONTROLLER W/O DISPLAY
(14) WALKWAY (STANDARD FOR "ADVANCED UK", OPTIONAL FOR "ADVANCED")

Contents

Overview 1-3

Pinsetter Orientation 1-4

Pinsetter Description 1-5
- Ball Pit 1-5
- Ball Cushion 1-5
- Transport Band 1-7

Ball Accelerator 1-8

Pin Elevator 1-10

Distributor 1-14

Setting Table 1-17

Sweep Wagon 1-26

Drive Frame 1-31

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Section 1: Operations

Overview

This manual is designed to help you service, repair, and perform preventive maintenance on the GS-Series Pinsetters in a safe and efficient manner. Prior to working on one of these pinsetters, you should read the safety informaton and be familiar with the *Safety Guidelines* located at the beginning of the manual.

This manual also provides troubleshooting guidelines that will help reduce downtime and can be used to provide years of reliable operation of your pinsetters.

Pinsetter Orientation

Whenever any position such as right, left, forward or rearward, is described this manual, the position is determined while viewing the machine from the foul line. The motion Clockwise (CW) and counterclockwise (CCW), is determined while looking at the pinsetter from the left side or top. Refer to *Figure 1-1* .

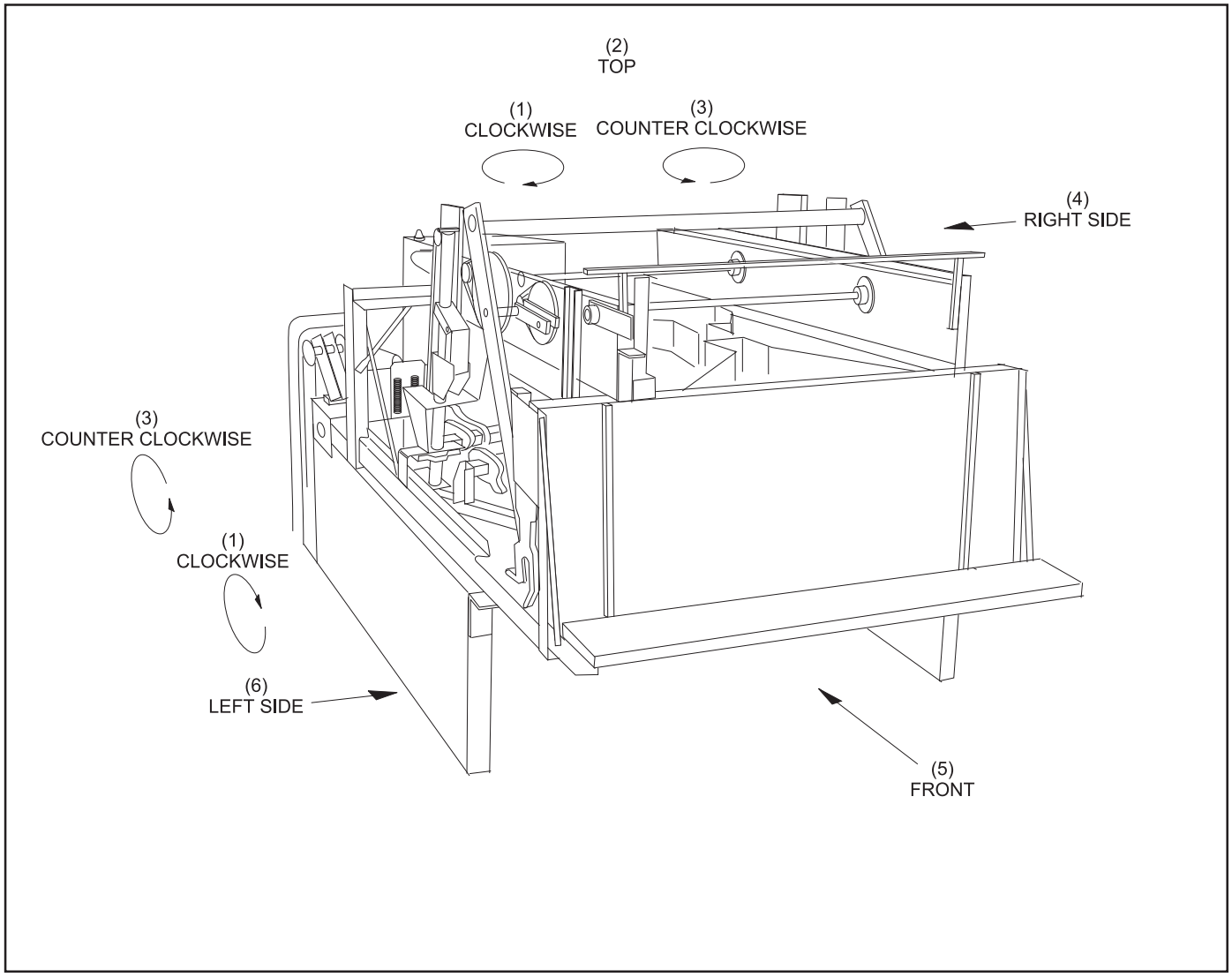

Figure 1-1. Pinsetter Orientation.

(1) CLOCKWISE
(2) TOP
(3) COUNTERCLOCKWISE
(4) RIGHT SIDE
(5) FRONT
(6) LEFT SIDE

Pinsetter Description

The GS-Series Pinsetters consist of eight subassemblies:

Ball Pit
Ball Accelerator
Pin Elevator
Distributor
Setting Table
Sweep Wagon
Drive Frame
Electronic Control

Ball Pit

The primary purpose of this area is to handle the initial impact of the pins and ball, separate them from each other, and direct them to the proper part of the machine.

The ball pit is made up of 2 main components:

1. Ball Cushion and Pin Curtain
2. Transport Band

Ball Cushion

The ball cushion is designed to absorb the impact of the ball and guide it to the ball accelerator's ball door. A shock absorber mounted to a pivoting cushion frame helps absorb the ball impact and return the cushion to its original forward position. Rubber facing and four protector or impact strips located on the bottom cushion board protect the ball and board from damage. The flaps at the bottom of the cushion near the ball accelerator act as a "check valve"allowing pins to travel under the cushion to the back of the machine while preventing them from returning forward where they may block the ball door. Refer to *Figure 1-2.*

Adjustments provided on the cushion assembly allow the user to control the forward position of the cushion so that the ball enters the ball accelerator without hitting the sides of the ball door opening and position the cushion side-to-side so that it doesn't rub on the kickbacks.

The pit curtain stops the rearward movement of the pins and creates a black background behind the pin deck.

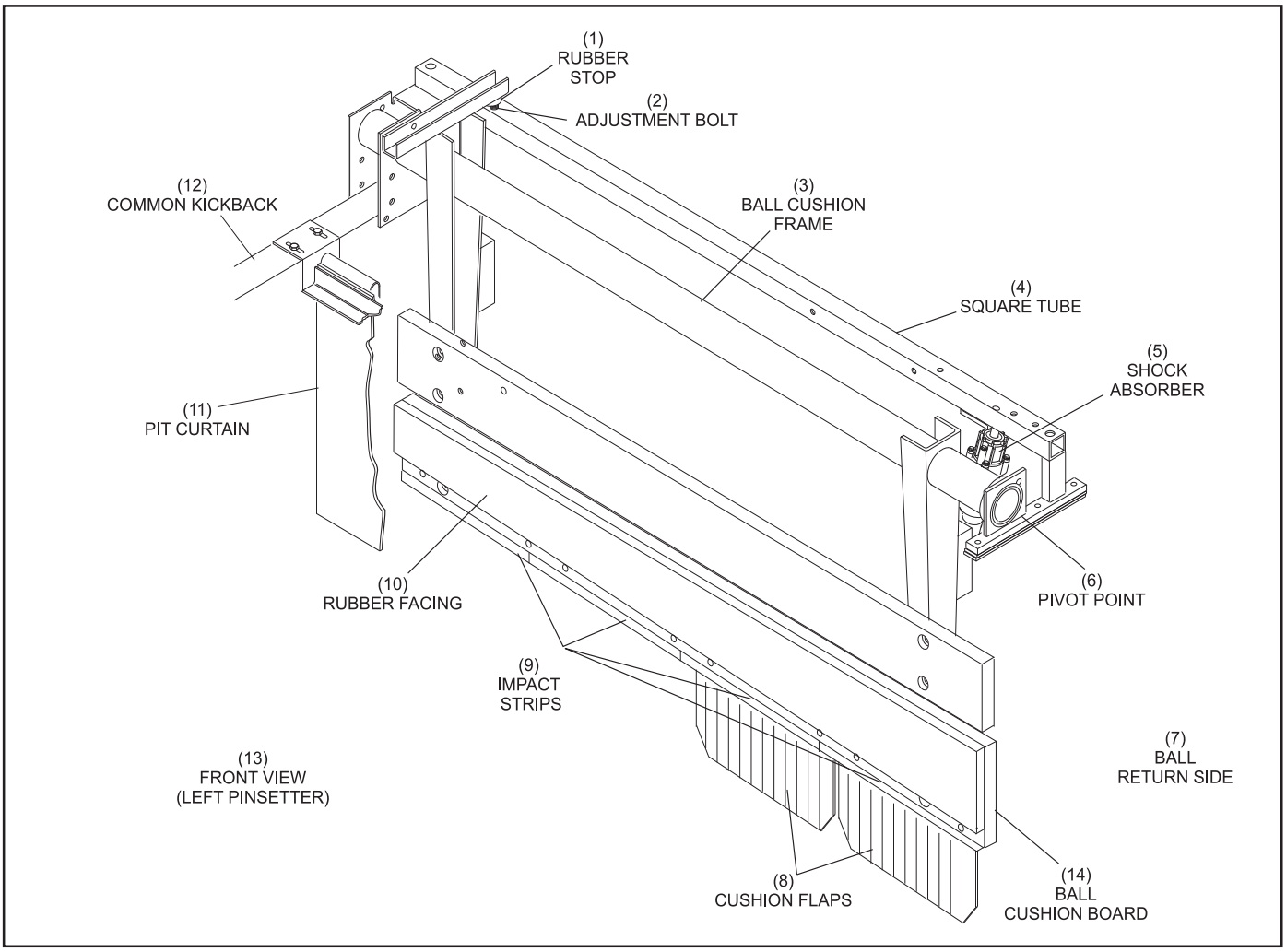

Figure 1-2. Ball Cushion.

(1) RUBBER STOP
(2) ADJUSTMENT BOLT
(3) BALL CUSHION FRAME
(4) SQUARE TUBE
(5) SHOCK ABSORBER
(6) PIVOT POINT
(7) BALL RETURN SIDE
(8) CUSHION FLAPS
(9) IMPACT STRIPS
(10) RUBBER FACING
(11) PIT CURTAIN
(12) COMMON KICKBACK
(13) FRONT VIEW (LEFT PINSETTER)
(14) BALL CUSHION BOARD

Transport Band

The Transport Band (T-band) brings the pins to the elevator assembly and holds the ball against the ball cushion while it is guided to the ball accelerator. The T-band consists of a large belt mounted around two rollers. The front roller is a fixed position roller that sits in slots of the side frames. The rear roller is an adjustable roller that is used to tension the belt and provide tracking so that the belt does not “drift” side to side. Fixed position tracking rollers near the front of each side frame assist in keeping the belt on track.

To support the weight of the bowling ball(s) and pins, two support boards are mounted between the side frames. The front board is a flat board while the rear one tapers downward at the ball door to allow the ball to enter the ball accelerator. The rear board is also rounded along its back edge to protect the belt from damage as pins return to the pit through the overflow chutes. Refer to *Figure 1-3.*

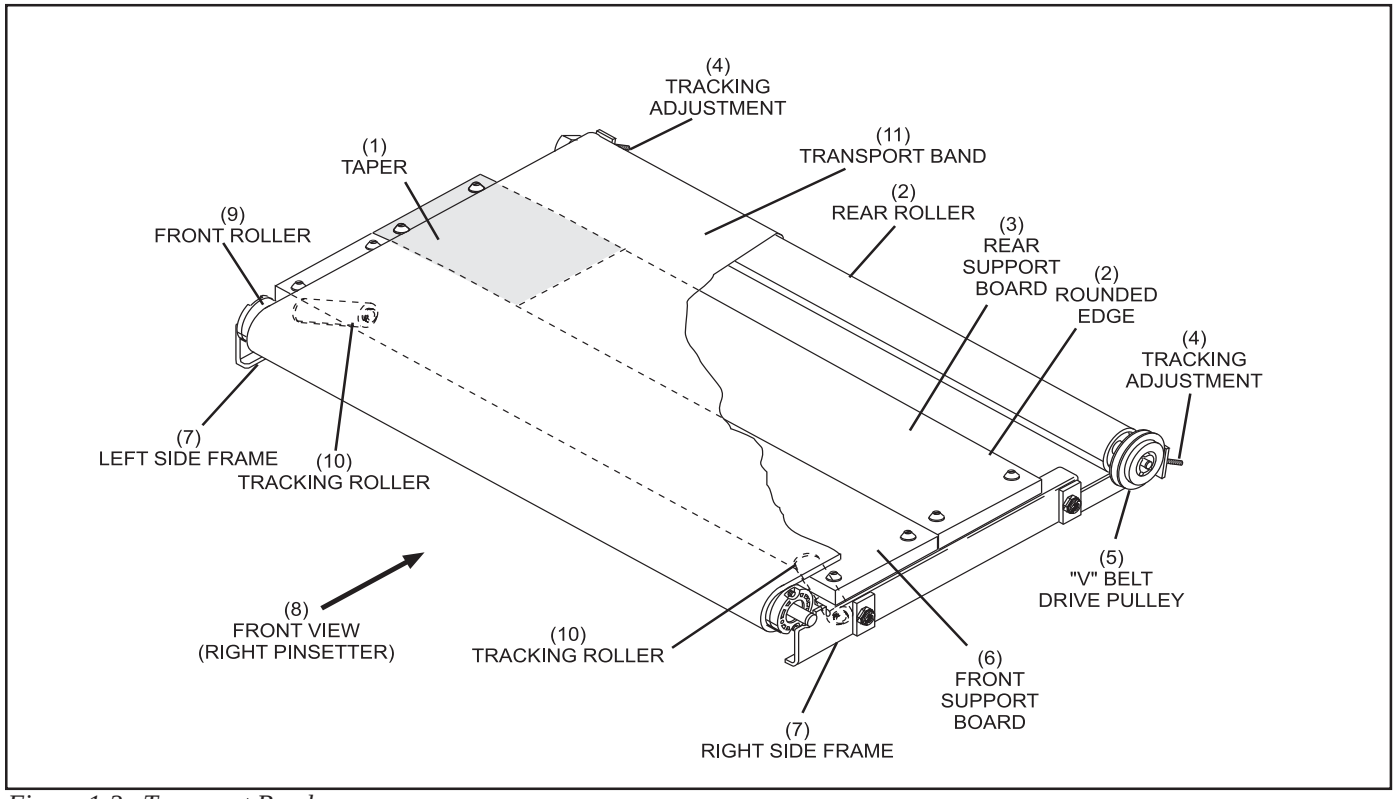

Figure 1-3. Transport Band.

(1) TAPER	(2) REAR ROLLER	(3) REAR SUPPORT BOARD
(4) TRACKING ADJUSTMENT	(5) “V” BELT DRIVE PULLEY	(6) FRONT SUPPORT BOARD
(7) SIDE FRAME	(8) FRONT VIEW (RIGHT PINSETTER)	(9) FRONT ROLLER
(10) TRACKING ROLLER	(11) TRANSPORT BAND	(12) ROUNDED EDGE

Ball Accelerator

Mounted between the two pinsetters of a lane pair is a ball accelerator that returns balls to the bowler from either lane. The ball enters the accelerator from the transport band through a ball door. A large flat belt mounted on two drums grips the ball and propels it forward to the ball lift. Refer to *Figure 1-4 Ball Accelerator.* Power to run the belt is furnished by a three phase motor incorporated into the rear drum.

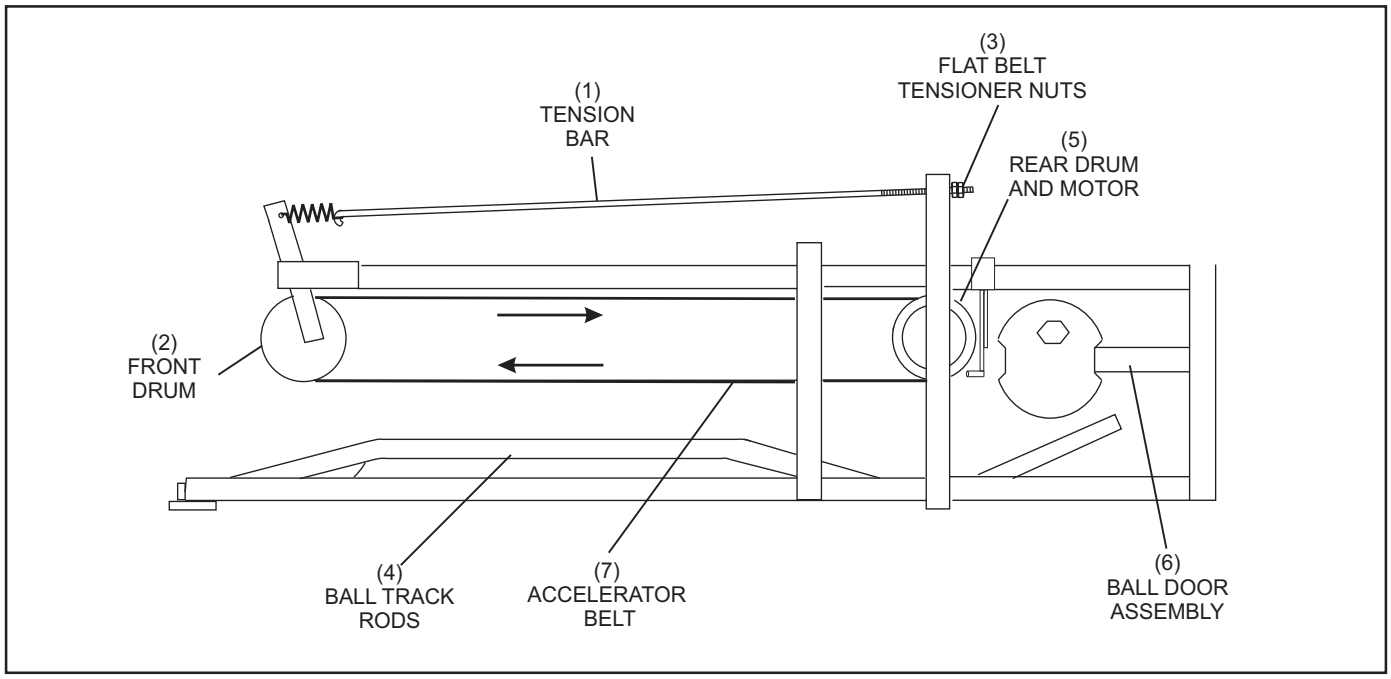

Figure 1-4. Ball Accelerator.

(1) TENSION BAR
(2) FRONT DRUM
(3) FLAT BELT TENSION NUTS
(4) BALL TRACK RODS
(5) REAR DRUM AND MOTOR
(6) BALL DOOR ASSEMBLY
(7) ACCELERATOR BELT

To prevent balls from opposite lanes from entering the accelerator at the same time and to prevent pins from entering the accelerator, ball doors and ball door locking assemblies are incorporated into the ball accelerator. See *Figure 1-5.*

When adjusted properly, the door cannot open simply by pushing it because a lever located at the top of the door will hit the locking bolt. To get the door to open, the button at the top of the door must be pressed. This causes the lever to lower so that it can pass under the locking bolt. The button is located at the top of the door so that pins carried rearward by the transport band cannot press the button.

A solenoid attached to the locking bolt is energized for 3-4 seconds after ball detection. Energizing the solenoid forces the locking bolt downward so that the door cannot open even if the button is pressed. This prevents pins from accidentally opening the door as they fall off the pin deck and gives the pins time to travel beyond the ball door area before the ball is allowed to open the door. Once a door is open, the door for the other lane is blocked from opening.

(1) BALL DOOR LOCKING SOLENOID
(2) LOCKING BOLT
(3) BALL DOOR CLOSING SPRING
(4) BUTTON
(5) BALL DOOR LEVER

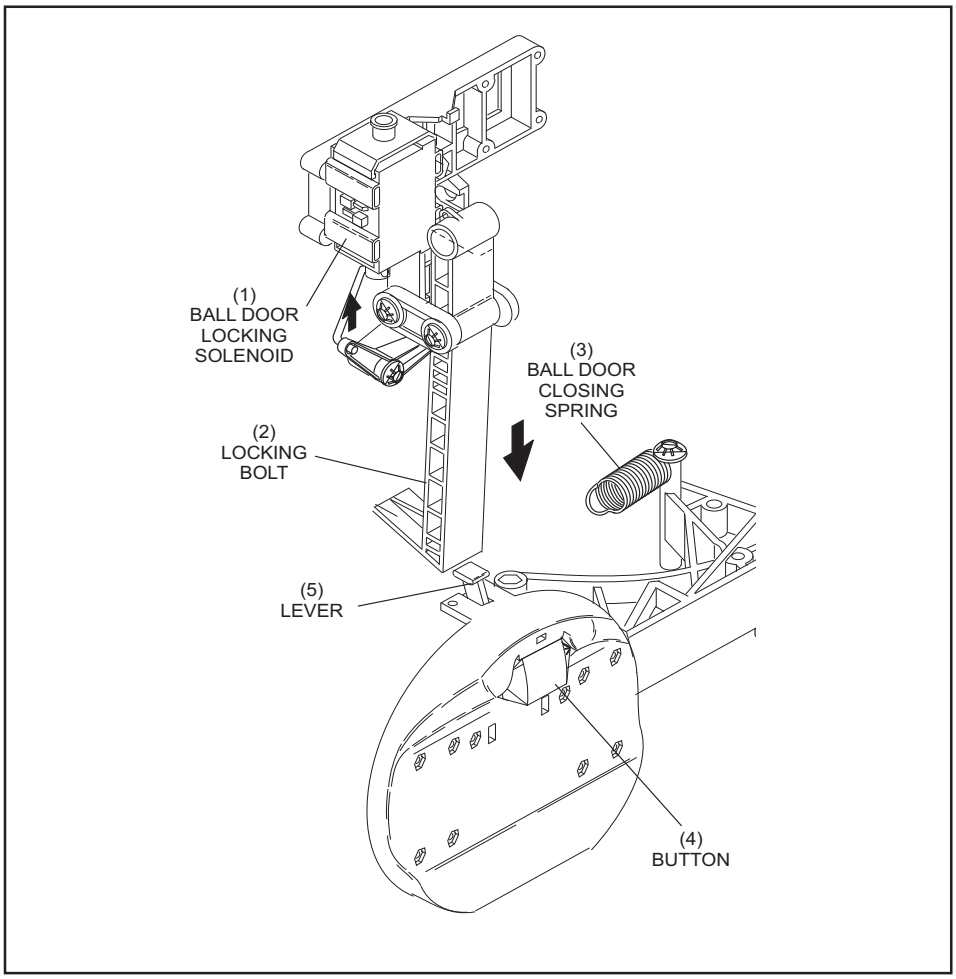

Figure 1-5. Ball Door Assembly.

Pin Elevator

The pin elevator receives the pins from the transport band and lifts them up to the distributor.

Two pin feed deflectors located at the bottom of the elevator funnel the pins into the elevator opening. As the pins enter the elevator they compete for a spot on one of 14 shovels that are continuously rotated around the elevator by two parallel chains. The chains are V-belt driven by the distributor motor.

As the shovels lift the pins, pin deflectors push the pins toward the middle of the shovel. This deflecting action will also knock poorly positioned pins off the shovel. As the pins travel up the elevator an ejector causes the shovel to gently wiggle to knock off any pin that is not securely held by the shovel or position it more securely on the shovel

A pair of pin centering wedges position the pin to the center of the shovel. This ensures proper pin alignment when entering the shark assembly.

At the top of the elevator, a shovel guide located on the right side of the elevator allows the front of the shovel to tip downward causing the pin to roll out of the shovel onto the shark assembly. As the pin drops onto the shark assembly, it actuates the pincount switch. This “signal” determines to which side of the distributor the pin will be sent.

It is expected that anytime the distributor motor is running, the elevator shovels will be rotating. To verify this, a switch called an Elevator Control switch (EC) gets actuated whenever a shovel passes it. (About every 2.5 seconds) If the EC switch is not actuated a least once every 6 seconds while the distributor motor is on, the machine will shut off with a Elevator Jam (EJ) error code to indicate that something is jammed in the elevator, there is too much weight on the transport band , or there is a problem with the distributor.

Machines equipped with base or fixed guards have an emergency stop switch mounted on the odd lane elevator. Pressing this button removes power from the Nexgen electronics, shutting off both lanes. When the switch is reset to restore power, the Nexgen will indicate a PF (Power Failure) code that must be cleared before the machine will turn on.

(1) ELEVATOR DRIVE SHAFT
(2) PIN COUNT SWITCH
(3) WEDGE GUIDE
(4) SHOVEL GUIDE
(5) CHAIN
(6) 1 OF 14 PIN SHOVELS
(7) EJECTOR
(8) RIGHT PIN DEFLECTOR
(9) RIGHT PIN FEED DEFLECTOR
(10) DAMPER PLATE
(11) LOWER PAN GUIDE
(12) LEFT PIN FEED DEFLECTOR
(13) LEFT PIN DEFLECTOR
(14) PIN CENTERING WEDGES
(15) EC SWITCH
(16) CHAIN TENSIONER
(17) STATUS LIGHT

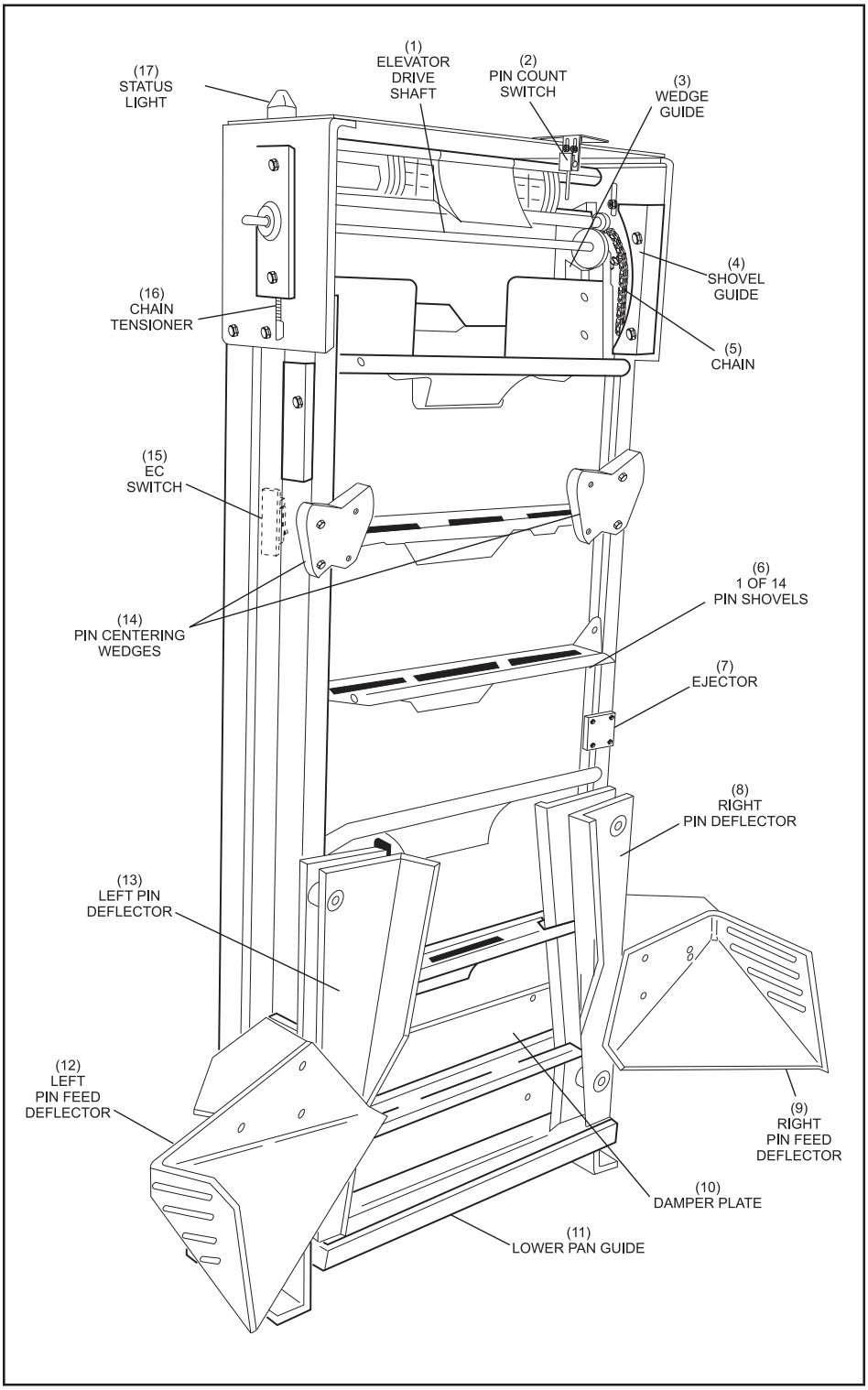

Figure 1-6. Elevator.

(1) STATUS LIGHT
(2) “EC” SWITCH
(3) LEFT MACHINE
(4) EMERGENCY STOP SWITCH
(5) REAR CONTROL BOX
(6) REMOTE DISPLAY (OPTIONAL)

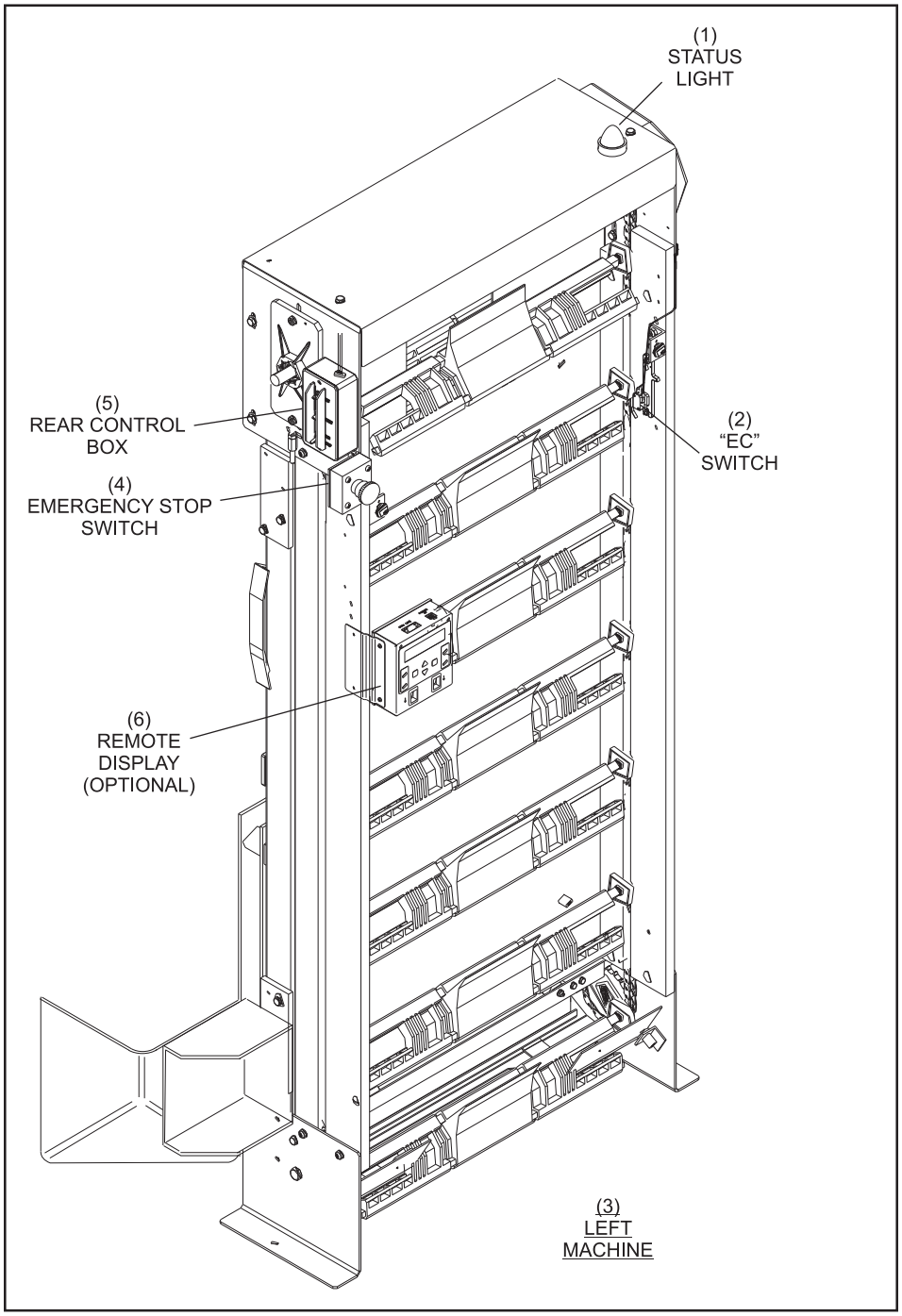

Figure 1-7. Elevator - Back View

Distributor

The distributor moves the pins from the elevator and places them in position so the setting table can receive them. The distributor consists of a shark assembly, four pin feed lanes, two cross over lanes, 10 pin stations, and right/left overflow chutes. See *Figure 1-8*

.

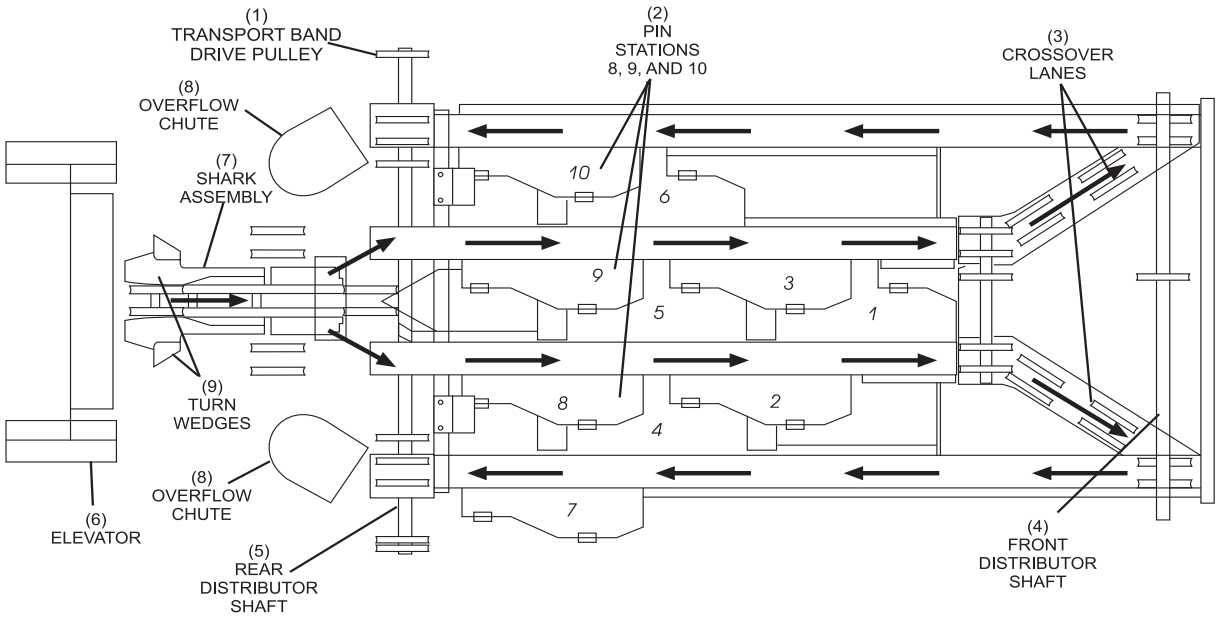

Figure 1-8. Distributor.

(1) TRANSPORT BAND DRIVE PULLEY
(2) PIN STATIONS 8, 9, AND 10
(3) CROSSOVER LANES
(4) FRONT DISTRIBUTOR SHAFT
(5) REAR DISTRIBUTOR SHAFT
(6) ELEVATOR
(7) SHARK ASSEMBLY
(8) OVERFLOW CHUTES

The shark switch assembly's turn wedges rotate the pin so that it will be positioned onto the distributor round belts bottom first.

A pincount switch on the top of the elevator monitors pins leaving the elevator. See *Figure 1-9*. Using this switch signal, the electronics sends voltage to the shark solenoid as needed so that the shark fin will force the pin to the right side of the distributor. The pins will alternate between the left and the right side of the distributor in the following repeating pattern; Left, Right , Left, Left, Right.

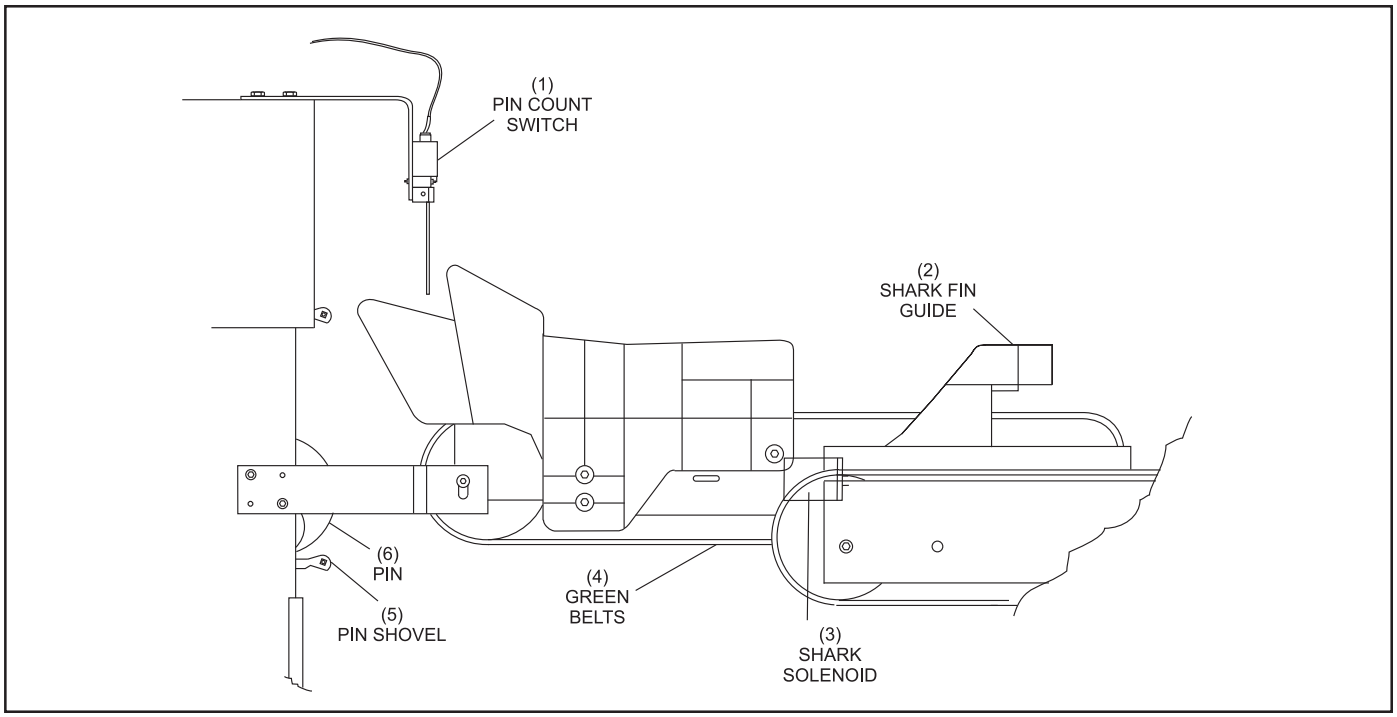

Figure 1-9. Pin Count Switch and Shark Solenoid.

(1) PIN COUNT SWITCH
(2) SHARK FIN GUIDE
(3) SHARK SOLENOID
(4) GREEN BELTS
(5) PIN SHOVEL
(6) PIN

The pins travel down the distributor lanes until an empty pin station is found. See *Figure 1-10*. At the empty pin station, the station's ejector flap sticking up between the two round belts will force the pin off the belts and onto the pin station's retaining bow. The weight of the pin forces the retaining bow down and in turn lowers the ejector flap. Additional pins traveling along the distributor lane, will pass by the occupied station. Pins are held in the pin station until the pinholder located on the setting table is ready to receive them. The pinholder's "open" gripper pushes the station's pin release lever upward allowing the retaining bow to pivot fully downward, releasing the pin.

There are three styles of pin stations:

- Left-hand for pins 2, 3, 4, and 9
- Right-hand for pins 1, 5, 6
- Short retaining bow flap - pins 7 and 10

(1) EJECTOR FLAP
(2) PIN RELEASE LEVER
(3) RETAINING BOW WITH FLAP

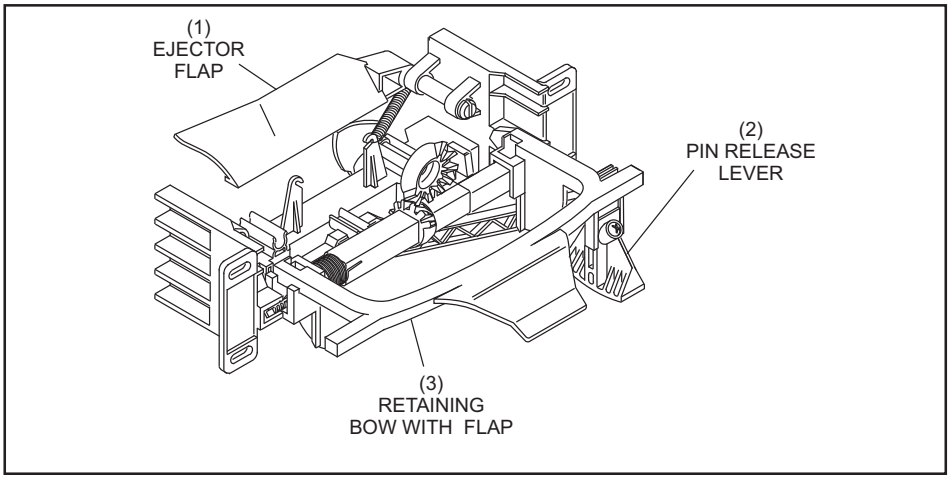

Figure 1-10. Pin Station.

A pin that does not find an empty pin station is returned to the transport band through the overflow chute located at the end of each outside distributor lane. See *Figure 1-11*.

If no bowling activity occurs for 45 - 60 seconds, the distributor motor will shut off to save energy and reduce wear on the pins and pinsetter.

(1) OVERFLOW CHUTE
(2) PIN IMPACT AREA BETWEEN REAR BOARD AND REAR ROLLER
(3) OVERFLOW SOCK

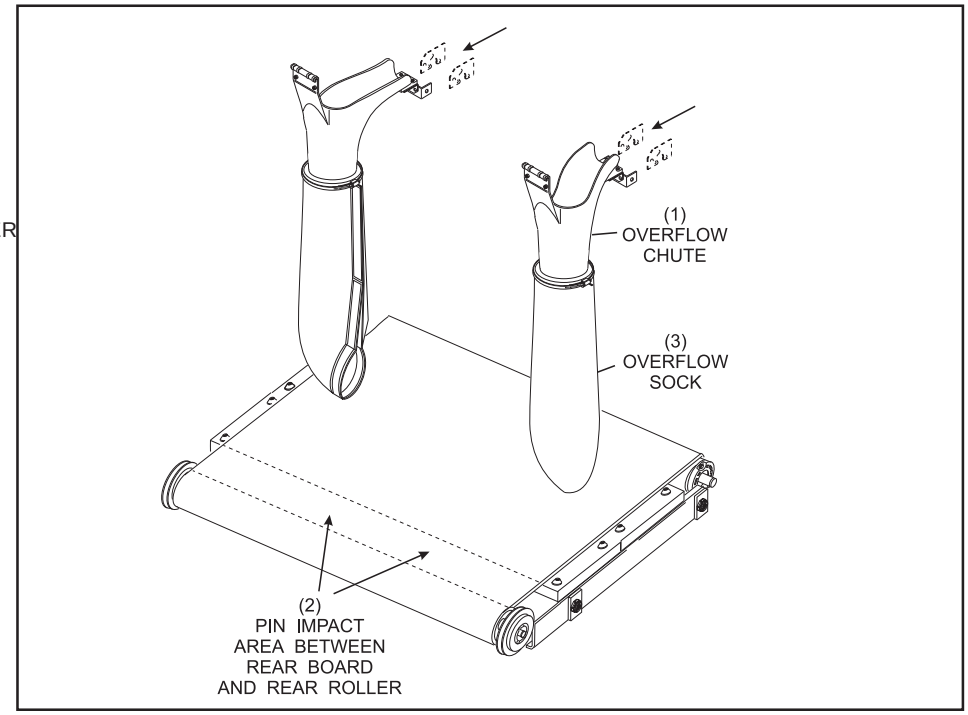

Figure 1-11. Pin Overflow Area.

Setting Table

The setting table is a multipurpose assembly. It must:

A. Detect standing pins after a ball has been rolled. *Figure 1-12.*
B. Pick up standing pins to allow the sweep to clear the dead wood. *Figure 1-13*.
C. Receive pins from the distributor and set them on the lane for a new frame. *Figure 1-14.*

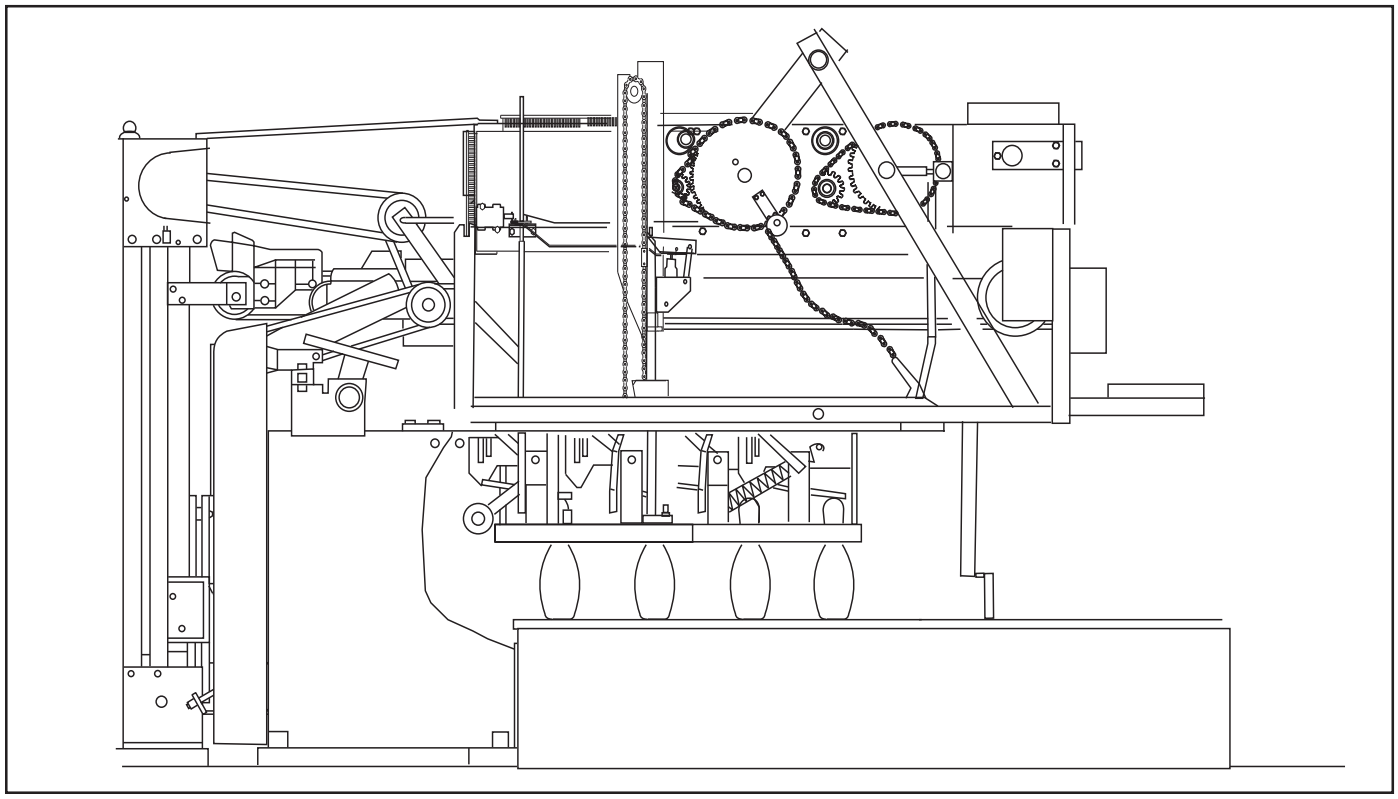

Figure 1-12. Detecting Pins

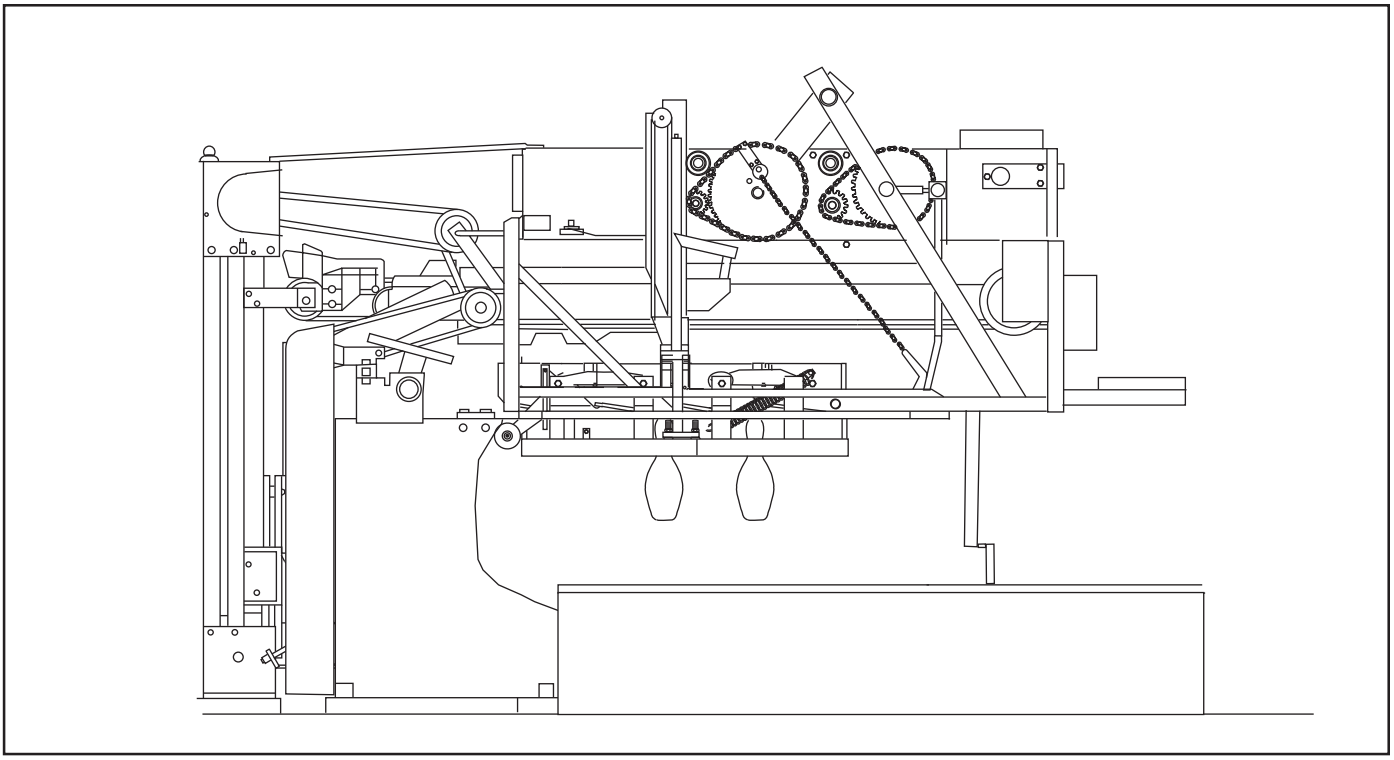

Figure 1-13. Spotting Tongs Closed - Picking Up Pins.

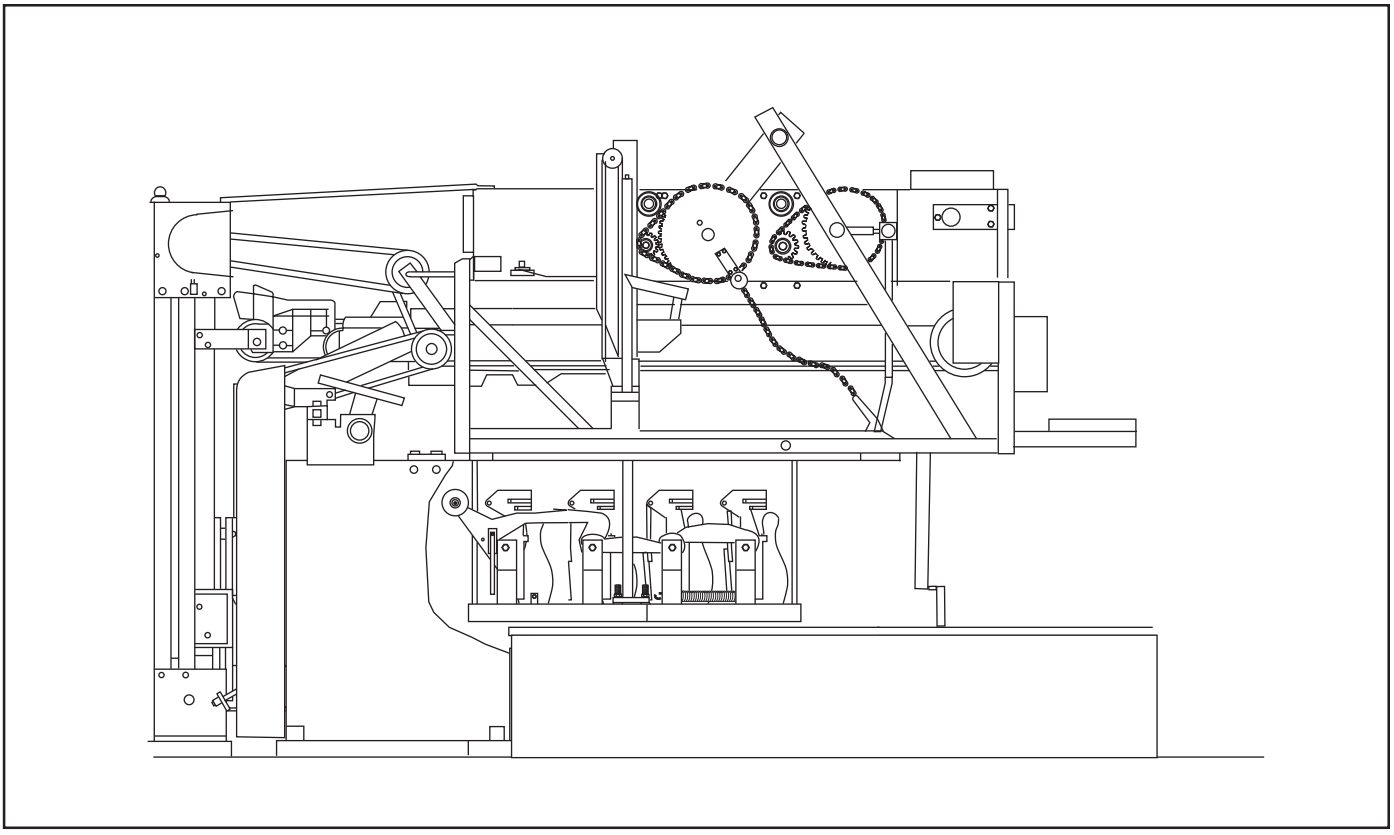

Figure 1-14. Setting New Pins.

The setting table contains ten pin holders mounted on four swing shafts. The pin holders are held in the horizontal position by a latch assembly located at the back left side of the setting table. The holders remain horizontal when the setting table is loading pins, waiting for a ball, or when it is detecting pins. The only time the pin holders are rotated to a vertical position is when the table lowers all the way down to set new pins onto the lane surface.

Each pin holder has an single internal switch that serves two purposes.

1. Detect standing pins so that the machine can determine what it needs to do and provide scoring if a scoring system is connected.
2. Determine when a pin has been loaded in the pin holder.

Even though the holder has only one switch, standing pins can be detected even when a pin has been loaded into the holder. This is done by checking whether the switch has changed status during pin detection. Refer to *Figures 1-15* .

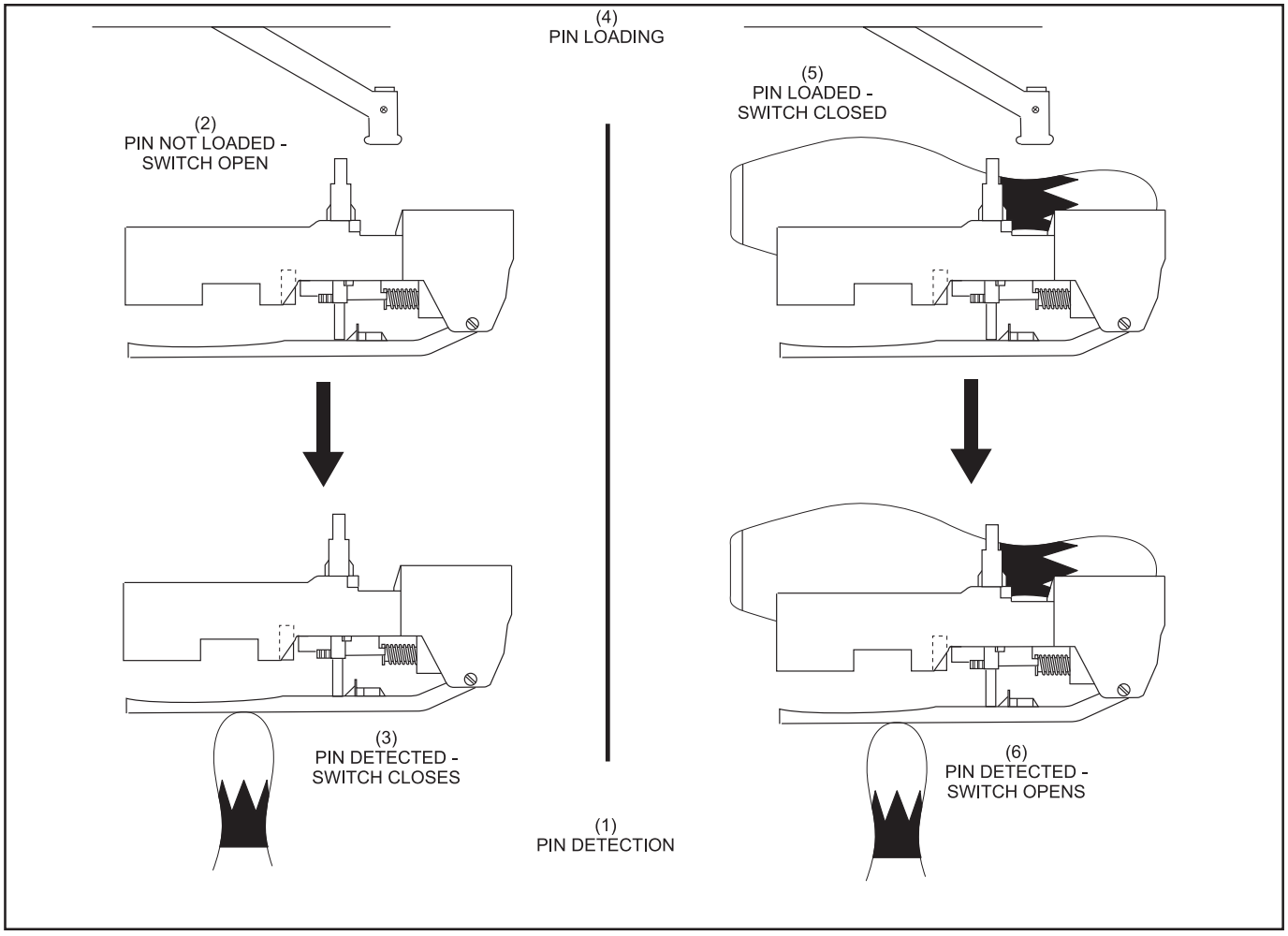

Figure 1-15. Pin Detection

(1) PIN DETECTION
(2) PIN NOT LOADED - SWITCH OPEN
(3) PIN DETECTED - SWITCH CLOSES
(4) PIN LOADING
(5) PIN LOADED - SWITCH CLOSED
(6) PIN DETECTED - SWITCH OPENS

Movement of the setting table is controlled by a motor and crank arm/chain drive assembly. Refer to *Figure 1-16*. As the crank arm rotates, the chain is let out and gravity causes the table to lower.

Normally the table will stop at pin detection height because a “T” stop screwed into the top of left hand table tube is “caught” by the stroke limiter plate prohibiting the table from lowering beyond the standing pin position. A shock absorber attached to the plate cushions the table so that it won’t knock over standing pins. A counter-weight attached to end of the chain in the right hand table tube takes up the chain slack as the crank arm continues its rotation. Refer to *Figure 1-17*.

The pinholders are “locked” in their horizontal position with a latch located near the 7 pin. If new pins are needed, a solenoid attached to the stroke limiter plate is energized. Energizing the solenoid causes the stroke limit plate to pivot out of the way of the T-Stop so that the table can lower to the pin deck. It also turns the left square shaft releasing the pinholder latch. A large spring attached to the swing shafts pulls the pin holders into the vertical position. Refer to *Figure 1-18* and *Figure 1-19.*

After the pins have been set onto the pin deck, a roller near the rear swing shaft is forced down by the TS1 Jam Assembly Arm, overpowering the spring, causing the pin holders to rotate back to the horizontal position. Refer to *Figure 1-20*. The latch will keep them in this position until the stroke limiter solenoid is energized again.

(1) SPROCKET
(2) TS-2 SWITCH
(3) “OOR” SWITCH
(4) CHAIN LENGTH PIVOT BEARING
(5) TABLE SHAFT
(6) CRANK ARM
(7) CRANK ARM ADJUSTING SCREWS
(8) TABLE LIFT CHAIN
(9) RIGHT HAND TABLE TUBE
(10) GUIDE TABLE TUBE

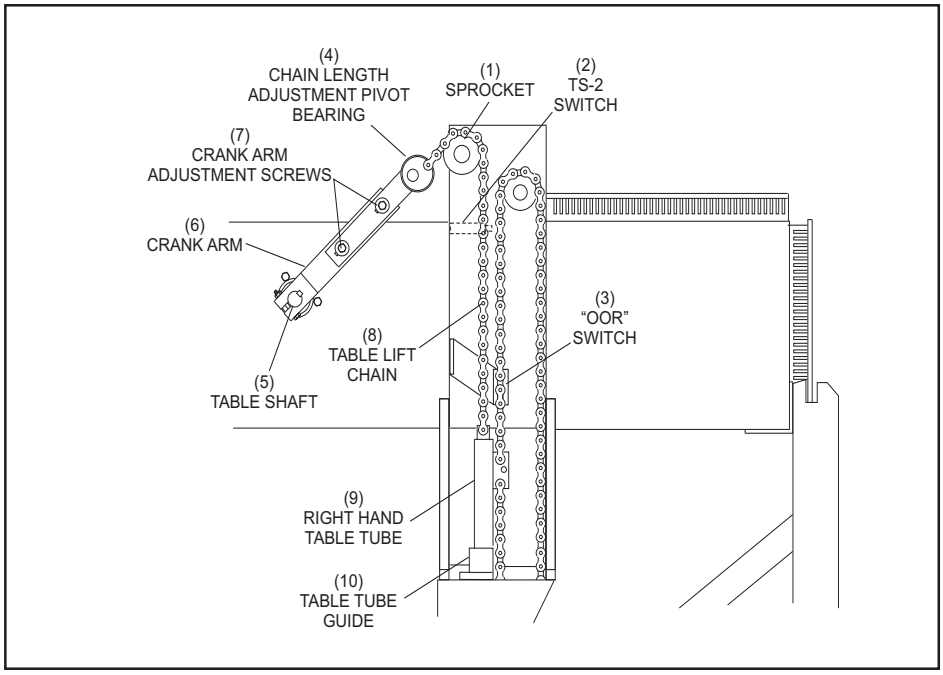

Figure 1-16. Right-Hand Table Rack

(1) LEFT-HAND SQUARE SHAFT
(2) STROKE LIMITER PLATE
(3) T-STOP
(4) LEFT-HAND TABLE TUBE
(5) STROKE LIMITER SOLENOID
(6) STROKE LIMITER SHOCK ABSORBER

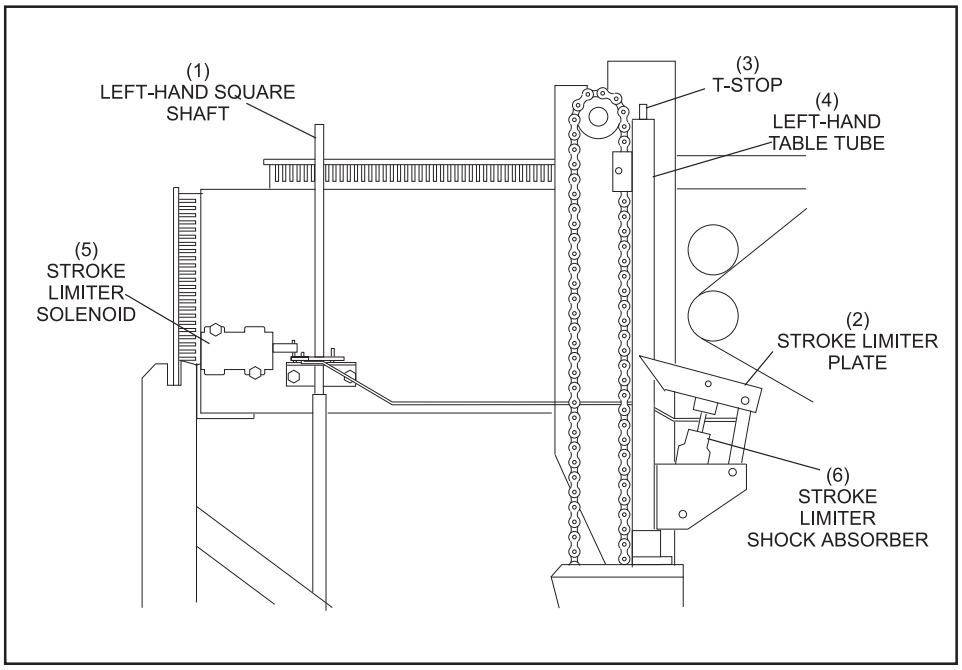

Figure 1-17. Left-Hand Table Rack with "T" Stop.

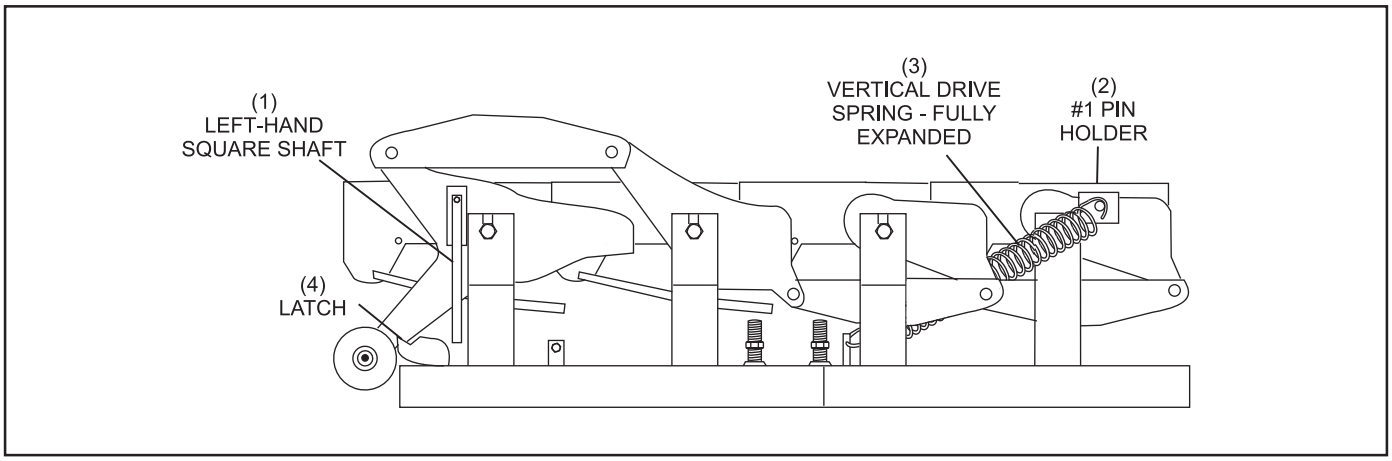

Figure 1-18. Table Up in Loading Pins Position.

(1) LEFT-HAND SQUARE SHAFT
(2) #1 PIN HOLDER
(3) VERTICAL DRIVE SPRING - FULLY EXPANDED
(4) LATCH

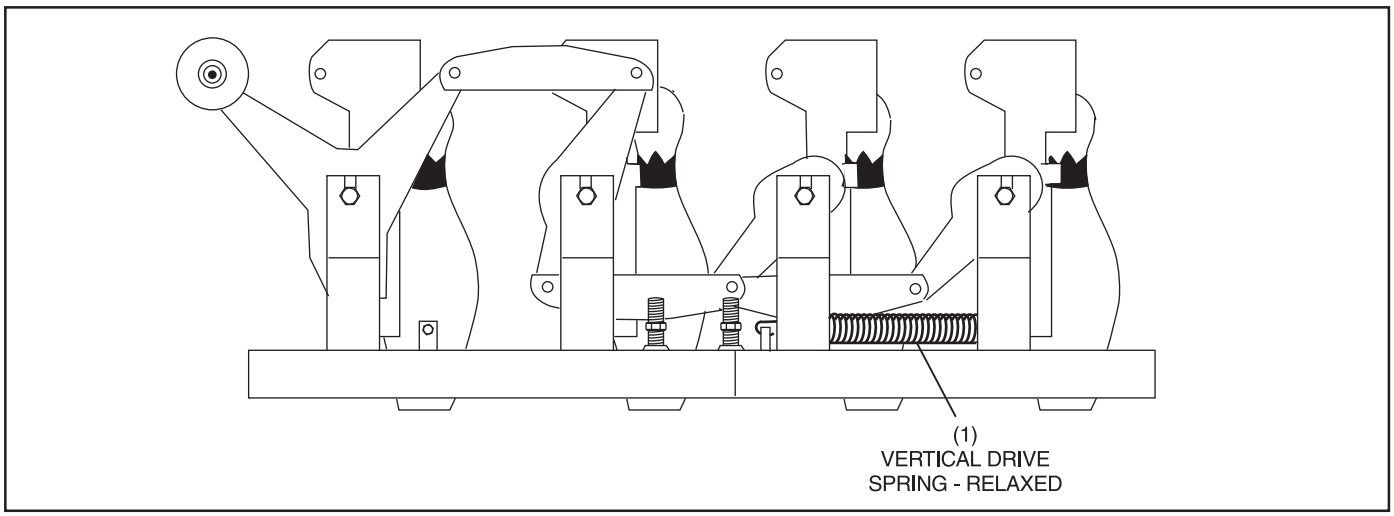

Figure 1-19. Setting New Pins Position.

(1) VERTICAL DRIVE SPRING - RELAXED

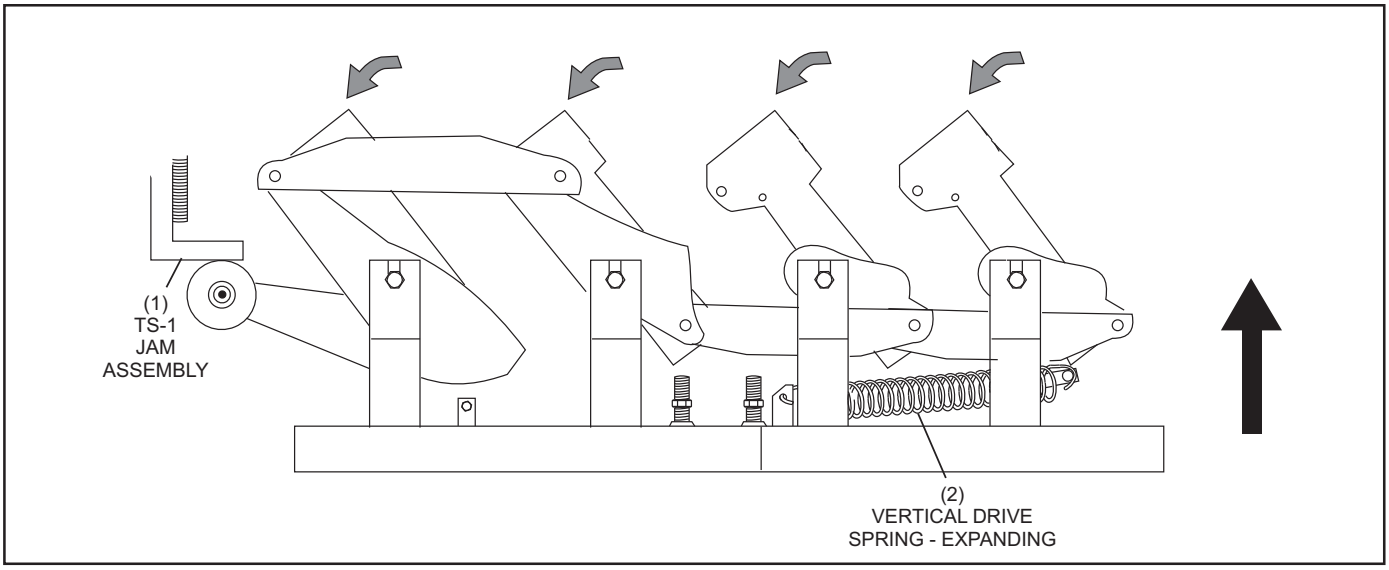

Figure 1-20. Table Raising - Pin Holders Returning to Horizontal Position.

(1) TS-1 JAM ASSEMBLY

(2) VERTICAL DRIVE SPRING - EXPANDING

To pick up standing pins, the setting table uses spotting tongs. The 10 spotting tongs are timed together and are driven through a series of gears and toothed racks by the machine's right square shaft. Refer to *Figure 1-21.*

This square shaft rotates when the spotting tong solenoid energizes to engage a gear clutch with the table drive. When the table motor is turning counterclockwise the square shaft will also turn couterclockwise to close the spotting tongs. When the tongs are closed their center pivot links lock the tongs in the closed position to prevent pins from dropping from the table when raised for clearing deadwood.

The square shaft turns in the opposite rotation re-opening the tongs when the table motor is turning clockwise. Refer to *Figure 1-21.*

(1) REAR SPOTTING TONG GEAR RACK
(2) "ST" SWITCH
(3) SPOTTING TONG (CLOSED)
(4) FRONT SPOTTING TONG GEAR RACK
(5) SPOTTING TONG MAIN GEAR RACK
(6) SQUARE SHAFT ATTACHMENT

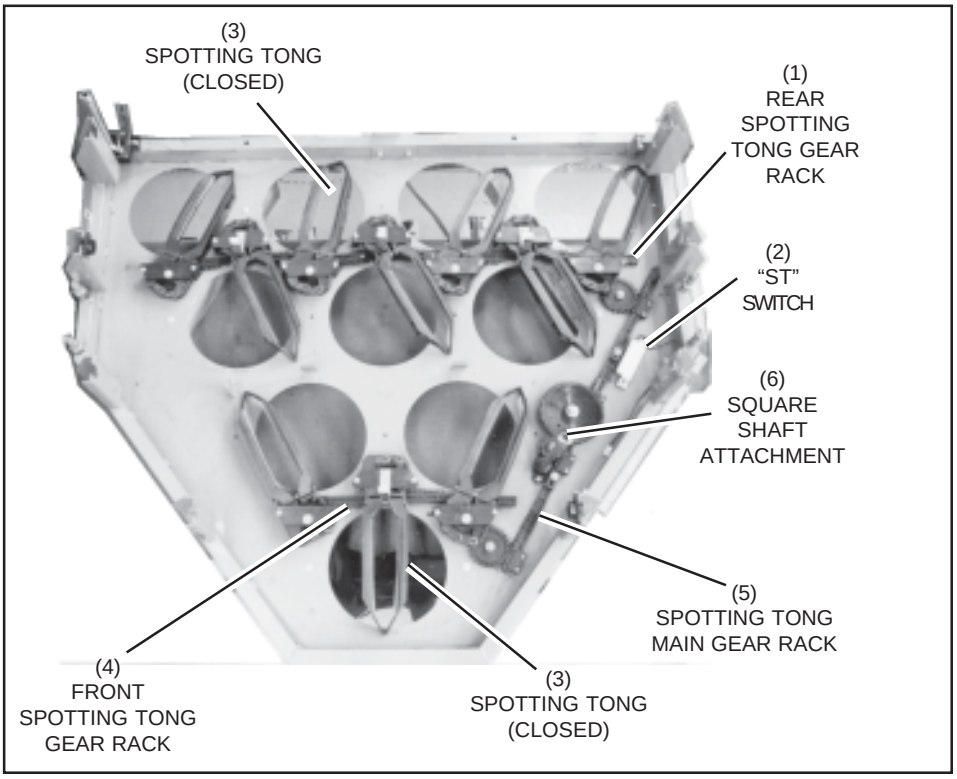

Figure 1-21. Spotting Tong Closing Position.

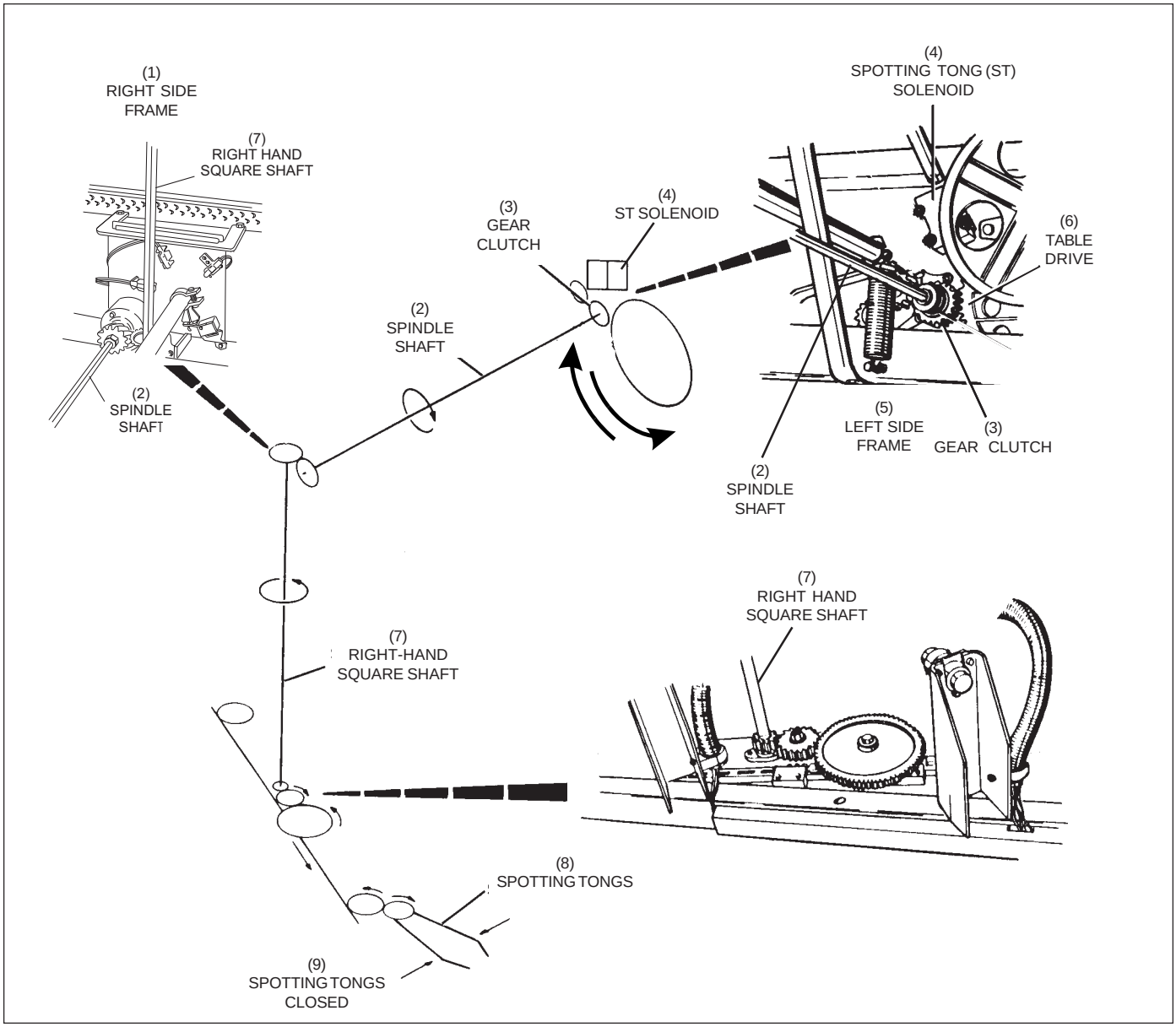

Figure 1-22. Spotting Tong Drive.

(1) RIGHT SIDE FRAME
(2) SPINDLE SHAFT
(3) GEAR CLUTCH
(4) SPOTTING TONG (ST) SOLENOID
(5) LEFT SIDE FRAME
(6) TABLE DRIVE
(7) RIGHT-HAND SQUARE SHAFT
(8) SPOTTING TONGS
(9) SPOTTING TONGS CLOSED

There are two types of spotting tongs:

Front facing - Pin 1, 4, 5, and 6
Rear facing - Pin 2, 3, 7, 8, 9, and 10

(1) CONNECTING LINKS IN LOCKED POSITION
(2) SPOTTING TONGS - CLOSED
(3) DAMPER
(4) SPOTTING TONGS - FULLY OPEN
(5) DRIVE GEAR

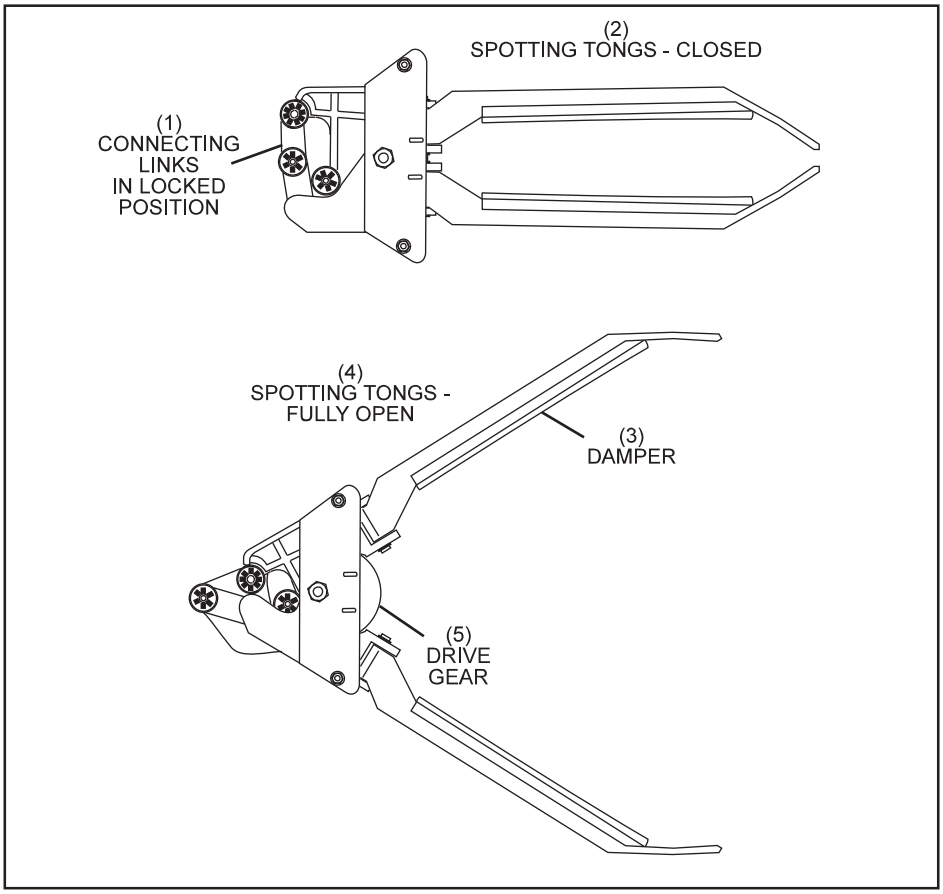

Figure 1-23. Spotting Tongs.

Sweep Wagon

The sweep wagon assembly has three functions:

1. Upon ball detection or manual triggering (SET or RESET), the sweep is lowered immediately to prevent pins from rolling forward onto the lane.
2. To guard the table as it lowers to detect or set new pins.
3. To sweep any pins that are no longer needed on the pin deck.

The sweep consists of four major components.

1. Sweep motor and drive gear
2. Sweep release assembly
3. Sweep attenuator/shock assembly
4. Sweep wagon

The sweep wagon is held up by the sweep release assembly. To lower the sweep wagon, the sweep release assembly's solenoid energizes to pull the swing lever rearward, allowing the tipper to rotate to drop the sweep wagon. A sweep attenuator, along with its shock absorber, controls the drop speed. When the sweep is fully down in the "guarding" position, switch "G" is actuated by the attenuator. Refer to *Figures 1-24* and *1-25*.

(1) SHOCK ABSORBER
(2) "G" SWITCH
(3) TIPPER
(4) SWEEP RELEASE LEVER
(5) SWING LEVER
(6) SWEEP RELEASE SOLENOID
(7) ATTENUATOR

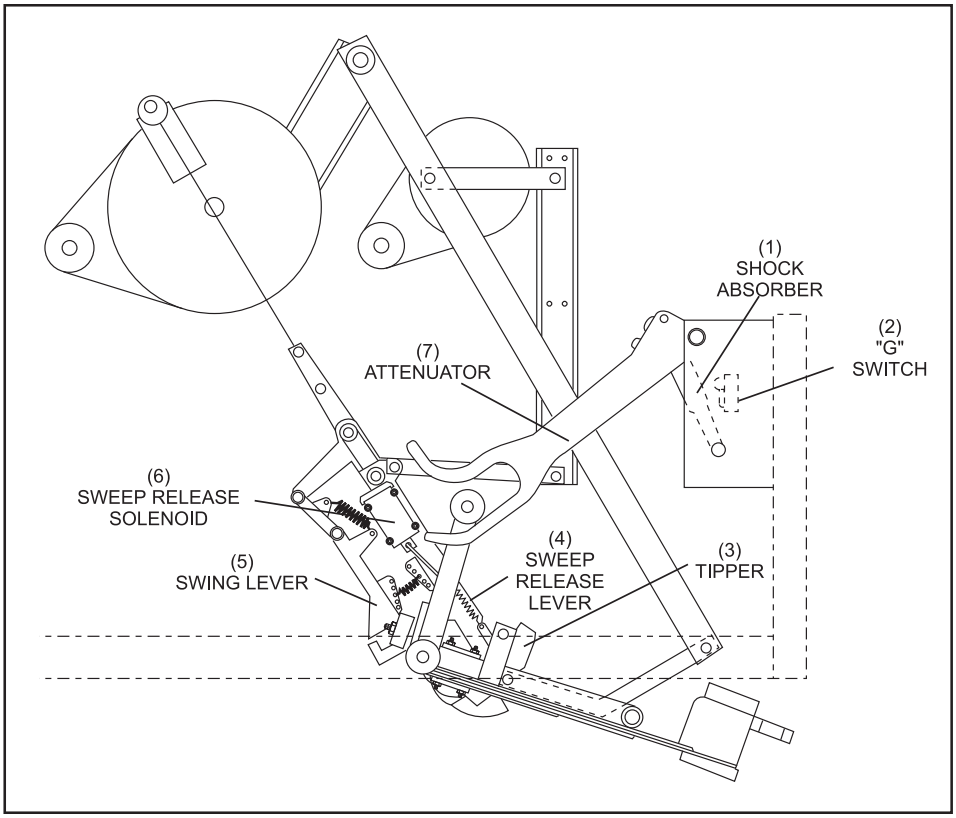

Figure 1-24. Sweep Release - Raised Position.

(1) PIVOT POINT
(2) SWEEP SHAFT
(3) SWEEP CRANK ARM
(4) “G” SWITCH
(5) SWEEP ATTENUATOR
(6) VERTICAL GUIDE ROLLERS
(7) PUSHER ROD
(8) FORWARD POSITION
(9) REARWARD POSITION
(10) HORIZONTAL GUIDE ROLLERS

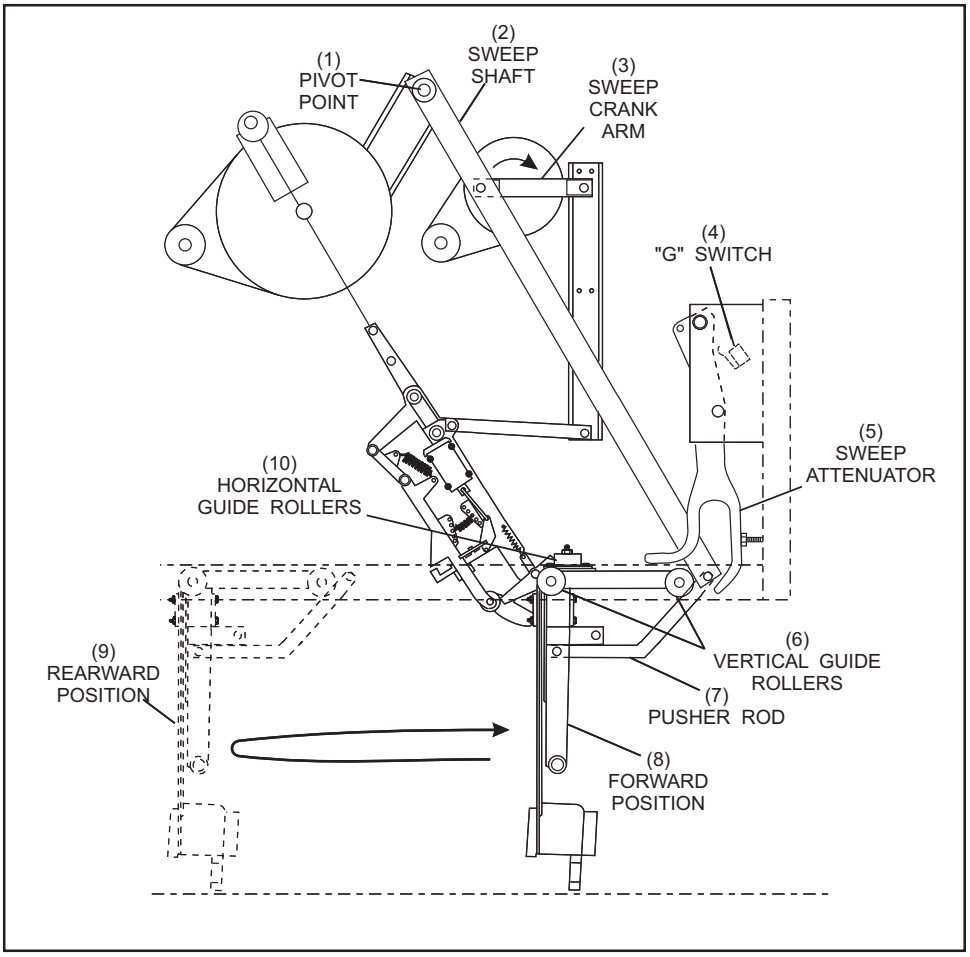

Figure 1-25. Sweep Motion.

Once the sweep is down in the guarding position, the sweep motor turns the sweep shaft clockwise. This rotates the sweep crank arms to drive the sweep shaft rearward then forward. Six guide rollers mounted on the sweep wagon, ensure that the wagon rolls smoothly and squarely in its sweep path. When the cam on the right side crank arm activates the Sweep Motor (SM) switch, the sweep motor shuts off and its internal brake engages to prevent the motor from coasting. This allows the sweep to be stopped exactly at the fully forward position. Refer to *Figure 1-26.*

(1) “SM” SWITCH
(2) SWEEP SHAFT
(3) CAM
(4) SWEEP DRIVE SHAFT
(5) RIGHT SIDE OF PINSETTER
(6) TABLE CRANK ARM

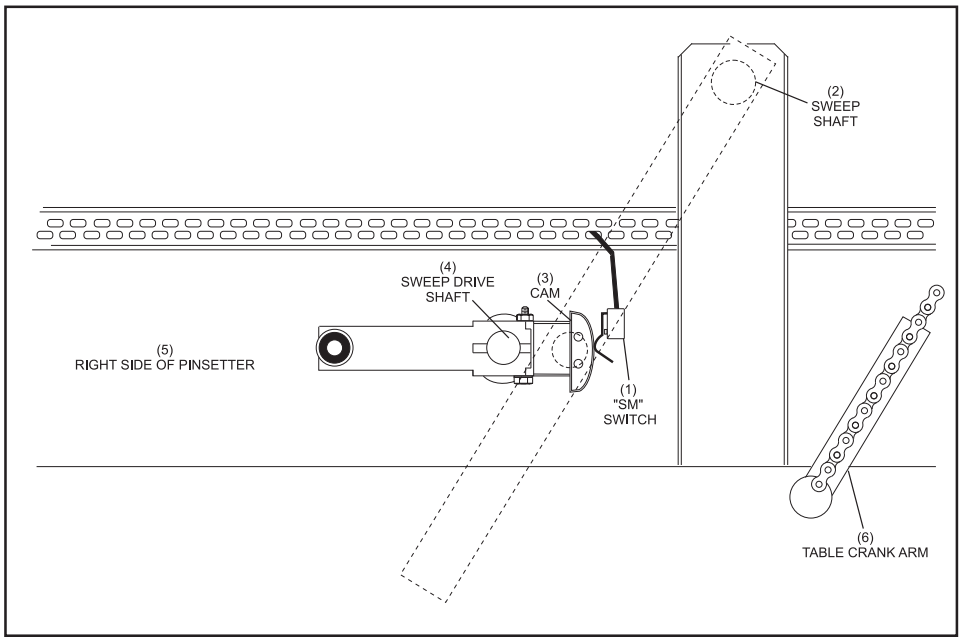

Figure 1-26. SM Switch Closed - Sweep Forward.

Near the end of the pinsetter cycle, the table motor and sweep release assembly work together with a pivot link to raise the sweep. During a pinsetter cycle, the table motor runs twice. The first time it runs counterclockwise. During this time it will be unable to raise the sweep, because of the angle of the release chain and sweep release assembly created by the pivot link prohibits the release assembly from “grabbing” the sweep. During the second half of a cycle, the table motor will run clockwise. This rotation positions the tipper on the sweep release arm under the the sweep wagon, raising the sweep along with the table.

It is important to note that the tipper of the release assembly can only come in contact with the roller when the table motor is turning clockwise. Refer to *Figures 1-27* and *1-28*.

(1) PIVOT BEARING
(2) PIVOT LINK
(3) TIPPER ROLLER
(4) TIPPER
(5) TABLE SHAFT

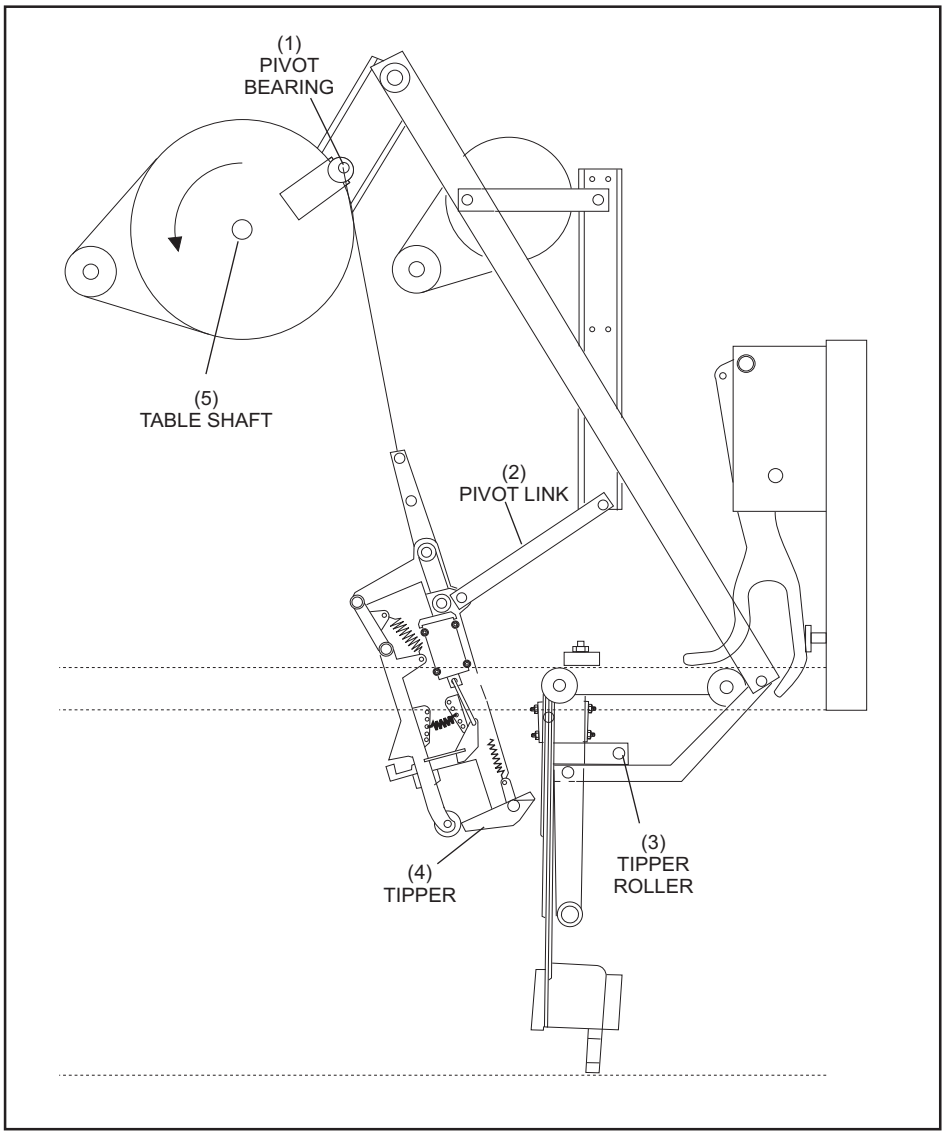

Figure 1-27. Sweep remains down (CCW).

(1) TABLE SHAFT
(2) PIVOT BEARING
(3) PIVOT LINK
(4) PIVOT POINT
(5) TIPPER ROLLER
(6) TIPPER

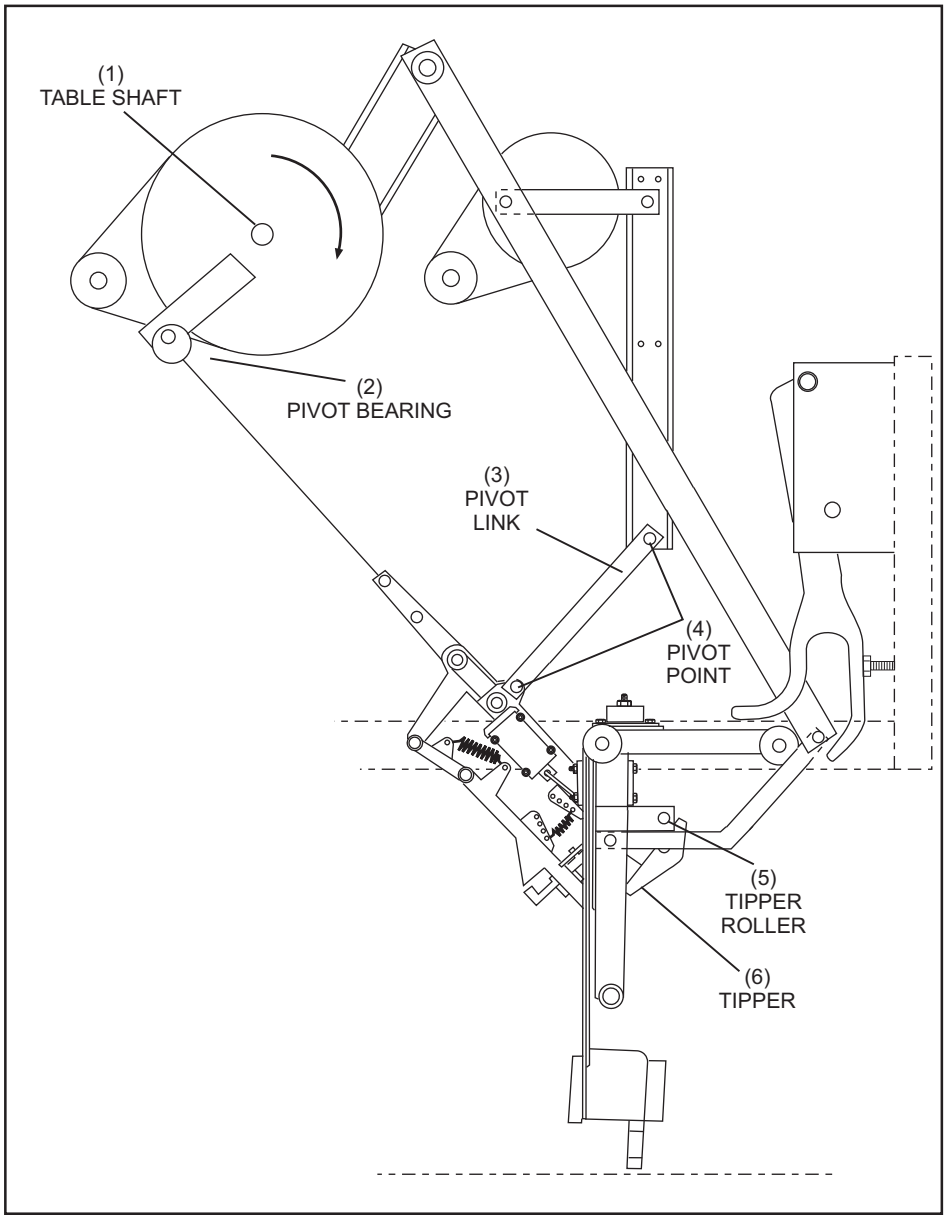

Figure 1-28. Raising the Sweep (CW).

Drive Frame

The left drive frame assembly consists of the three motors along with their drive systems and the stroke limiter assembly. See *Figure 1-29*.

The front motor is a 1/2 HP motor without an internal brake called the distributor motor. It uses a double pulley system to drive the front distributor shaft and in turn the assemblies that move the pins through the machine. This includes the distributor belts, the shark assembly, the elevator and the transport band.

The center motor is a 1/4 HP motor called the sweep motor. Its function is to drive the sweep rearward and forward. This motor has an internal brake to prevent coasting when power is turned off thus stopping the sweep precisely in the forward position .

The rear motor is the table motor. Its main purpose is to raise and lower the setting table. This motor is the only one on the machine that turns both clockwise and counterclockwise. This is neccesary because it also drives spotting tongs open and closed and it raises the sweep wagon at the end of a cycle. The 1/2 HP motor has an internal brake that locks the motor shaft when the motor is turned off. Ths primary reason for the brake is to hold the table up is its home position. For this reason never remove the setting table's V-belt without first lowering the table to a safe position.

WARNING!

Removing the setting table motor's V-belt can cause the setting table to fall and crash to the pindeck, possible causing damage or injury. Always lower the setting table fully to the pindeck BEFORE removing the setting table motor V-belt.

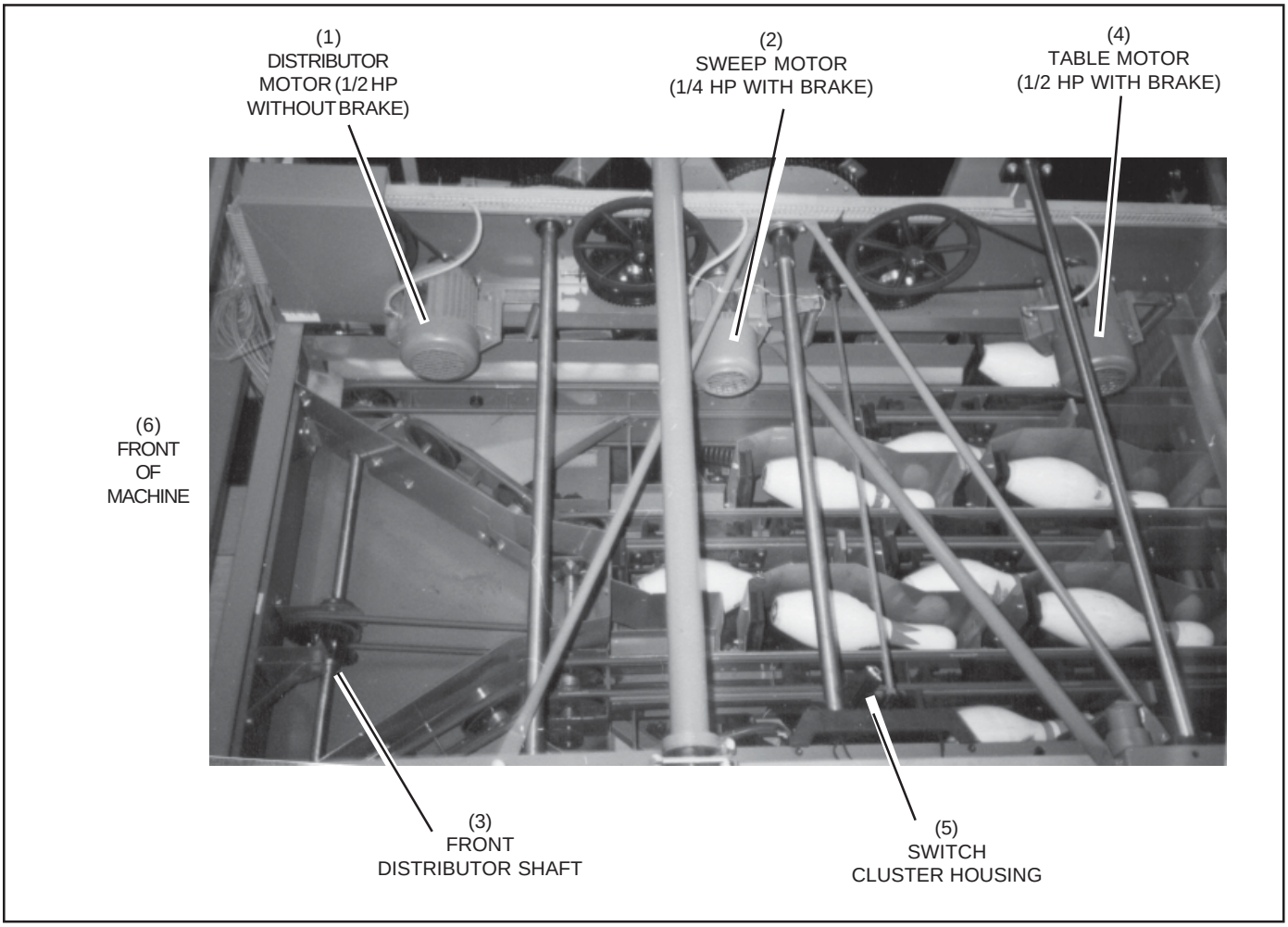

Figure 1-29. Drive Frame Assemblies.

(1) DISTRIBUTOR MOTOR (1/2 HP WITHOUT BRAKE)
(2) SWEEP MOTOR (1/4 HP WITH BRAKE)
(3) FRONT DISTRIBUTOR SHAFT
(4) TABLE MOTOR (1/2 HP WITH BRAKE)
(5) SWITCH CLUSTER HOUSING
(6) FRONT OF MACHINE

The stroke limiter assembly determines whether the table lowers to the standing pin detecting height or the new pin setting height. It consists of a stroke limiter plate, a hydraulic shock absorber, a solenoid, and a square shaft. The plate and shock absorber slows the table as it lowers for a short stroke to detect or respot pins. A solenoid pulls the stroke limiter plate out of the path of the "T" stop located at the top of the left-hand table rack so the table can lower fully to the new pin setting height. It also rotates the left-hand square shaft to unlatch the swing shafts allowing the pin holders to rotate vertical so new pins can be set on the lane. Refer to *Figure 1-30.*

(1) LEFT-HAND SQUARE SHAFT
(2) STROKE LIMITER PLATE
(3) T-STOP
(4) LEFT-HAND TABLE TUBE
(5) STROKE LIMITER SOLENOID
(6) STROKE LIMITER SHOCK ABSORBER

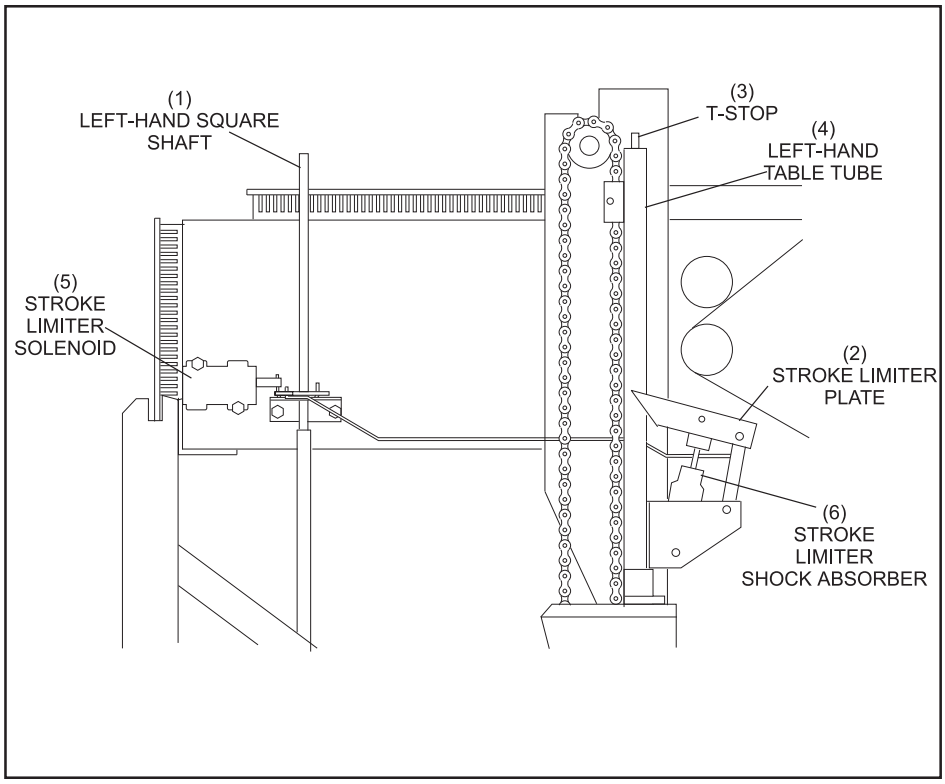

Figure 1-30. Stroke Limiter Assembly.

The right drive frame assembly contains a switch cluster housing and the guide tower assembly.

The switch cluster assembly contains four switches labeled "A","B","C" and "D" that inform the Pinsetter CPU of the location of setting table. See *Figure 1-31*.

(1) SWITCH "C"
(2) SWITCH "B"
(3) CAM
(4) SWITCH "A"
(5) TABLE SHAFT
(6) SWITCH "D"

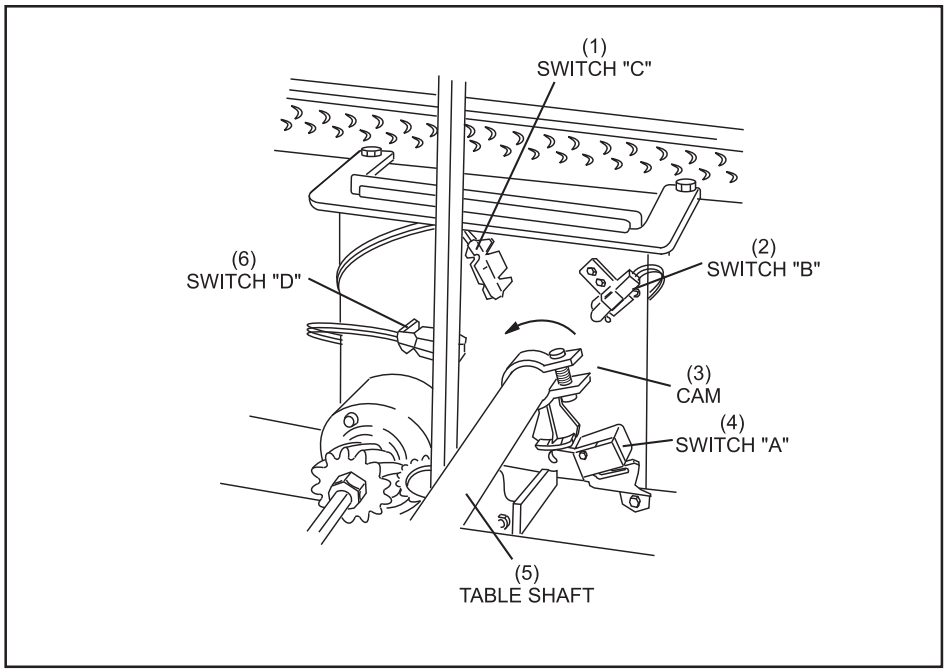

Figure 1-31. Switch Cluster Assembly.

The right-hand guide tower is bolted onto the pinsetter drive frame. See *Figure 1-32.* At the top is a sprocket on which the table chain rides as the table is raised and lowered.

An out-of-range switch (OOR) is used to determine if the table actually lowered to the proper detection height. The table jam switch TS-2 activates if too much torque is needed to raise the table to its home (up) position.

(1) SPROCKET
(2) TS-2 SWITCH
(3) "OOR" SWITCH
(4) CHAIN LENGTH ADJUSTMENT PIVOT BEARING
(5) TABLE SHAFT
(6) CRANK ARM
(7) CRANK ARM ADJUSTING SCREWS
(8) TABLE LIFT CHAIN
(9) RIGHT HAND TUBE GUIDE
(10) TUBE GUIDE

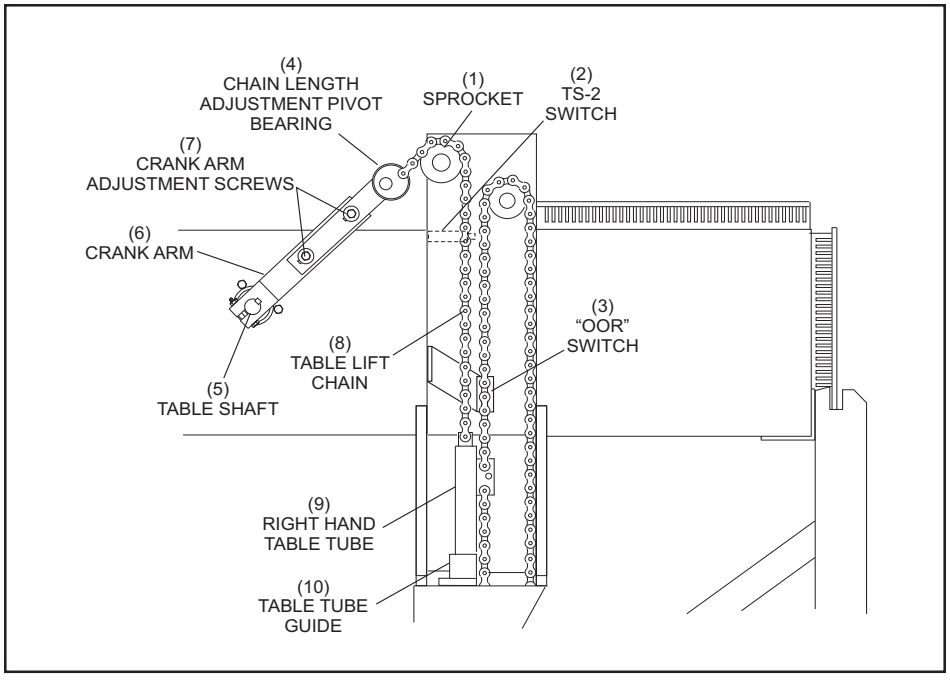

Figure 1-32. Right-Hand Guide Tower Assembly.

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Contents

Section 2: Electrical - Switches, Solenoids and Motors 2-3

Switches 2-3

Switches “A”, “B”, “C” and “D” 2-4
Error Code “A” Switch 2-4
Error Code “B” Switch 2-5
Error Code “C” Switch 2-5
Error Code “D” Switch 2-5

Elevator Control Switch (EC) 2-6
Error Code “EC” Switch 2-6

Switch “G” 2-7
Error Code “G” Switch 2-7
Mechanic’s Rear Control Switches (Standard on pinsetters) ... 2-8
Mechanic’s Remote Display (Optional on pinsetters) 2-9

Out-Of-Range Switch 2-10
Error Code “OOR” Switch 2-10

Pin Holder Switches 2-11
Error Codes - Pin Loading and Detecting 2-11

Spotting Tong Switch (ST) 2-12
Error Codes “ST” Switch 2-12

Sweep Motor Switch (SM) 2-13
Error Codes “SM” Switch 2-13

TS-1 Switch 2-14
Error Code 2-14

TS-2 Switch 2-15
Error Code 2-15

Pin Count Switch 2-16
Error Code 2-16

Emergency Off Switches (Base and Fixed Guards) 2-17

Solenoids 2-18

Ball Door Solenoid 2-20

Sweep Release Solenoid 2-21

Stroke Limiter Solenoid 2-22

Spotting Tong Solenoid 2-23

Pin Holder Solenoids 2-24

Shark Solenoid 2-25

Motors 2-26
Distributor Motor 2-27
Sweep Motor 2-27
Table Motor 2-27
Ball Accelerator Motor 2-27

Switches

The GS-X pinsetters contain numerous function and safety switches that control and protect the pinsetter and provide safety for the operator. When a function switch is not working properly or if it is not actuated as expected, the machine will shut off and display an error code describing the failure.

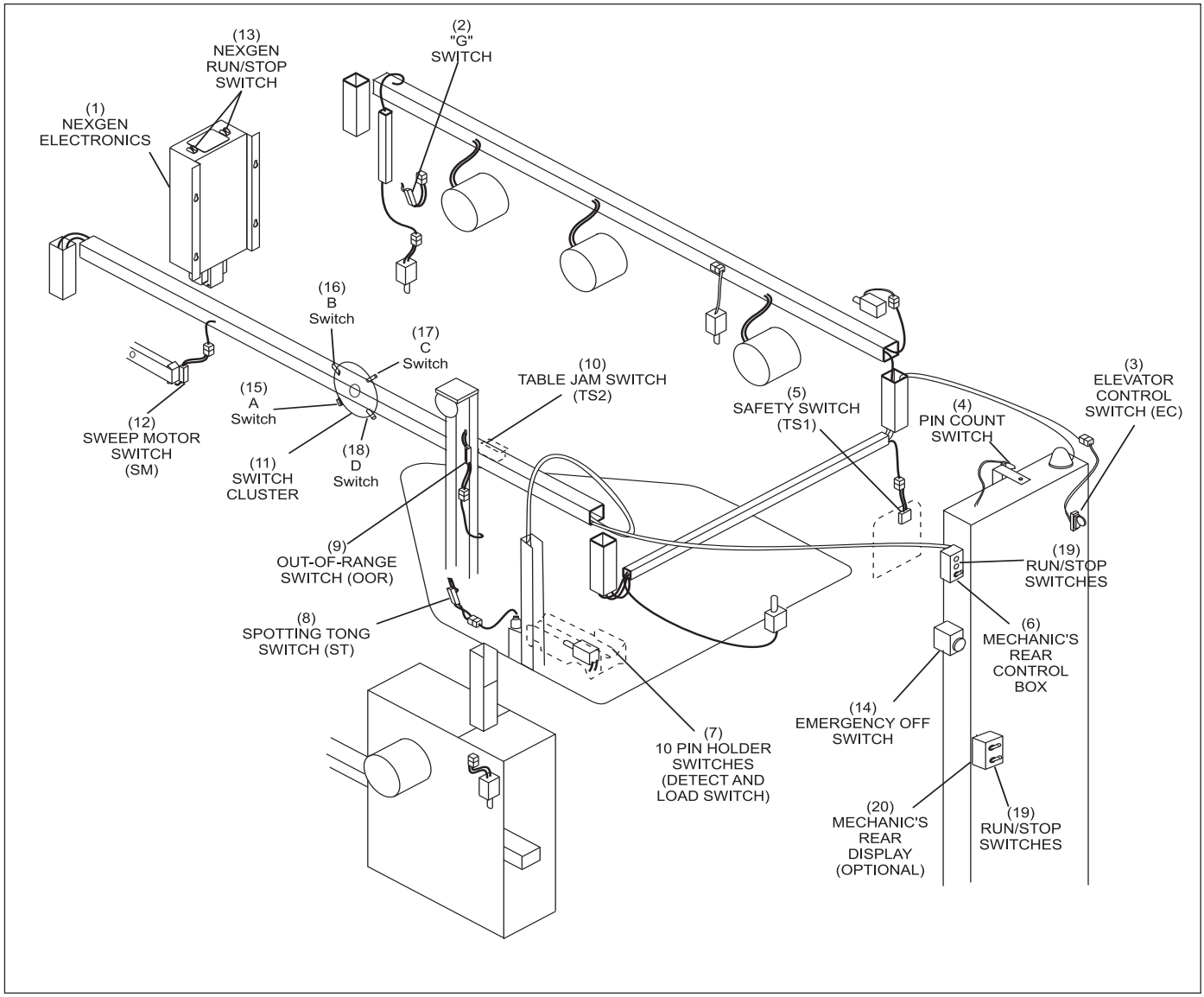


Figure 2-1. Switches - Base and Fixed Guard Packages

(1) NEXGEN ELECTRONICS	(2) "G" SWITCH	(3) ELEVATOR CONTROL SWITCH (EC)
(4) PIN COUNT SWITCH	(5) TABLE JAM SWITCH (TS1)	(6) MECHANIC'S REAR CONTROL BOX
(7) 10 PIN HOLDER SWITCHES (DETECT AND LOAD SWITCH)	(8) SPOTTING TONG SWITCH (ST)	(9) OUT-OF-RANGE SWITCH (OOR)
(10) TABLE JAM SWITCH (TS2)	(11) SWITCH CLUSTER	(12) SWEEP MOTOR SWITCH (SM)
(13) NEXGEN RUN/STOP SWITCH	(14) EMERGENCY OFF SWITCH	(15) SWITCH A
(16) SWITCH B	(17) SWITCH C	(18) SWITCH D
(19) RUN/STOP SWITCHES	(20) MECHANIC'S REAR DISPLAY (OPTIONAL)	

Switches “A”, “B”, “C” and “D”

These switches are mounted on a switch cluster housing located inside the right frame of the pinsetter. The primary function of the switch cluster is to inform the Pinsetter CPU of the position of the setting table. The “A” switch is a mechanical microswitch that is held closed by an actuator when the table is up in the home position. Switches “B”, “C”, and “D” are actuated by a magnet mounted on the end of the actuator as the table is being lowered or raised. The “B” and “D” switches indicate that the table is in the standing pin detection position. The “C” switch indicates that the drive chain and crank arm are fully extended and the table is fully down at the pin deck or completely resting on the stroke limiter.

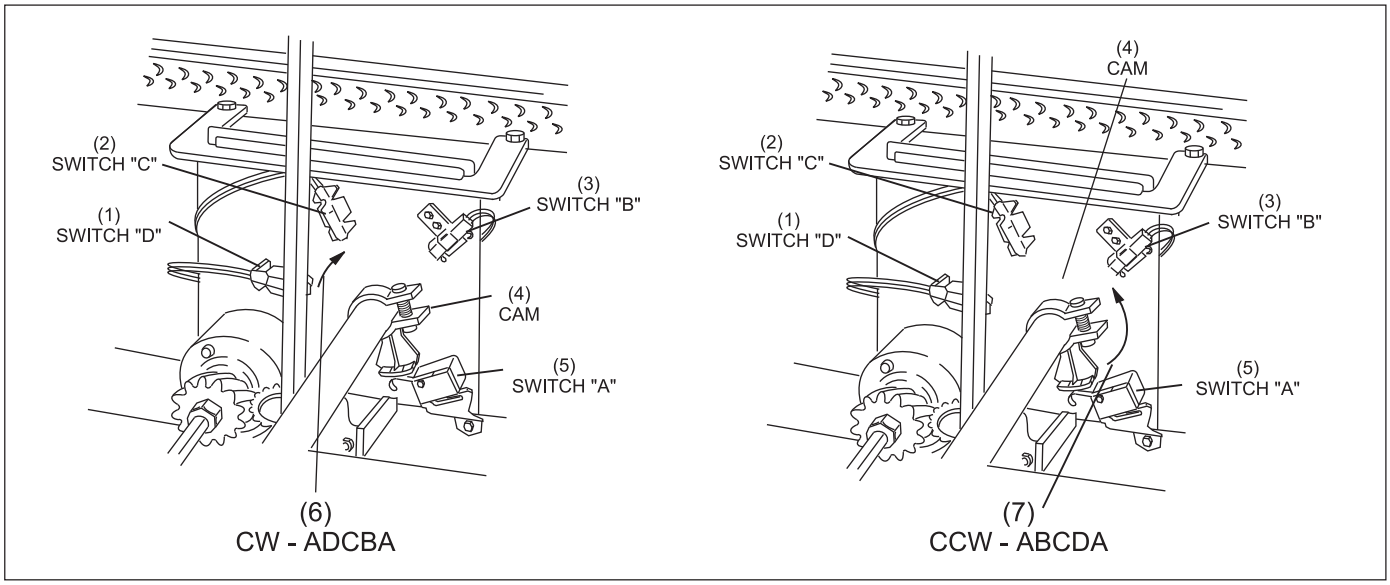


Figure 2-2. Switch Cluster.

(1) SWITCH “D”
(2) SWITCH “C”
(3) SWITCH “B”
(4) CAM
(5) SWITCH “A”
(6) CLOCKWISE - ADCBA
(7) COUNTERCLOCKWISE - ABCDA

Error Code “A” Switch

A FOUND	60	SWITCH A NOT EXPECTED BUT FOUND
A NTFND	70	SWITCH A EXPECTED BUT NOT FOUND
Invld 0 - Invld 5	**90-95**	**INVALID MACHINE STATE**

Error Code "B" Switch

B FOUND	61	SWITCH B NOT EXPECTED BUT FOUND
B NTFND	71	SWITCH B EXPECTED BUT NOT FOUND

Error Code "C" Switch

C FOUND	62	SWITCH C NOT EXPECTED BUT FOUND
C NTFND	72	SWITCH C IS EXPECTED BUT NOT FOUND

Error Code "D" Switch

D FOUND	63	SWITCH D NOT EXPECTED BUT FOUND
D NTFND	73	SWITCH D EXPECTED BUT NOT FOUND

Elevator Control Switch (EC)

The EC switch is located on the left rear frame of the elevator. It is pulsed by rollers on the pin shovel shaft as the shovels rotate. If it is not pulsed at least once every six seconds when the distributor motor is running, the Pinsetter CPU determines that the elevator is either jammed, a drive belt is slipping, or some other defect or problem in the distributor or transport band is preventing the elevator from moving. The pinsetter will shut off and indicate an error.

(1) SHOVEL DRIVE CHAIN
(2) EC SWITCH
(3) SHOVEL ROLLER

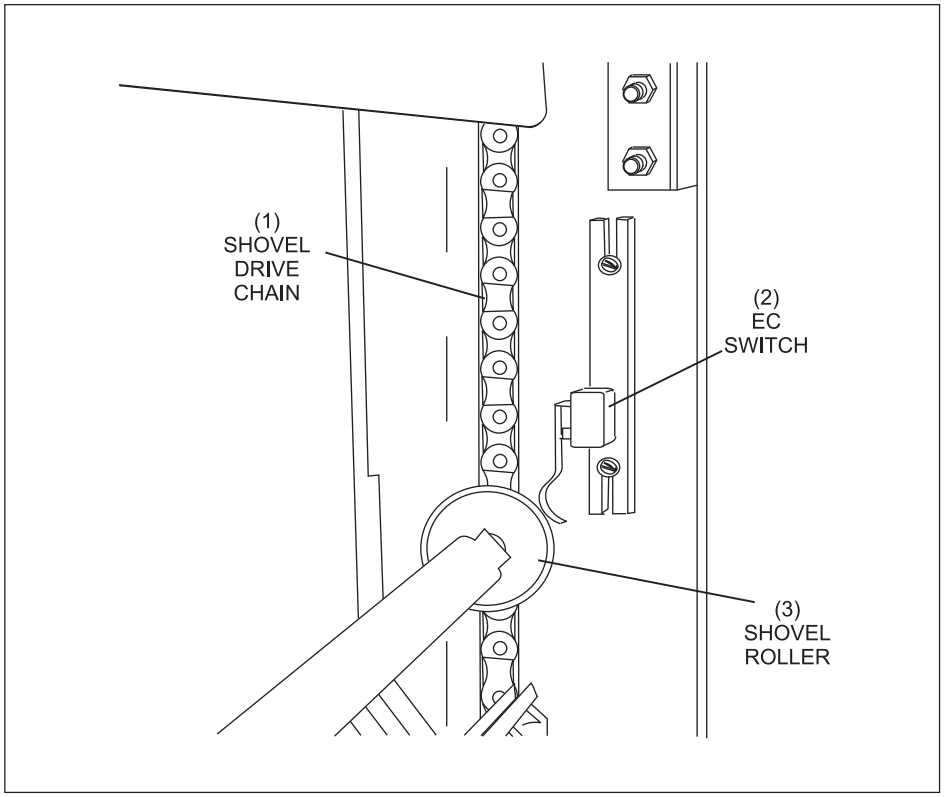


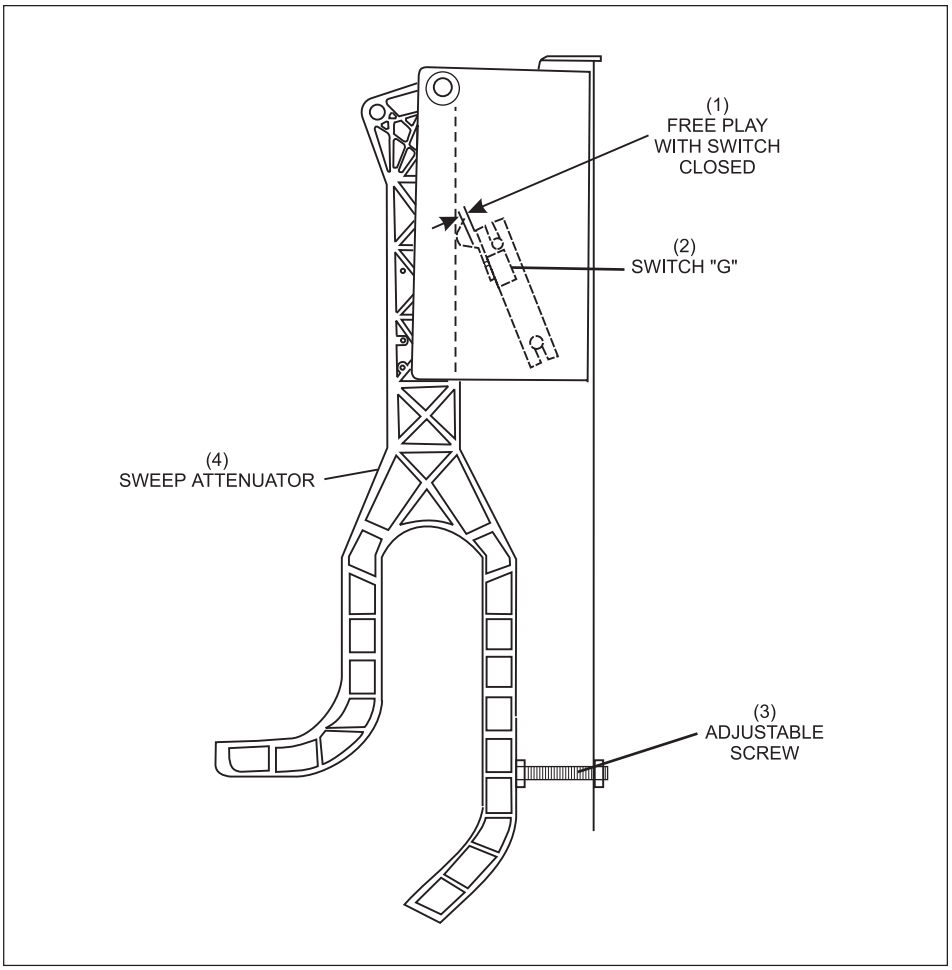
Figure 2-3. Shovel Roller Pulsing EC Switch.

Error Code "EC" Switch

ElevJam	EJ	ELEVATOR JAM

Switch "G"

This "G" switch is located under the attenuator at the front left side of the pinsetter. This switch is actuated by the attenuator when the sweep is all the way down in the guarding position. The switch must be actuated before the table can be lowered. During operation, the sweep release solenoid energizes upon ball detection. If the "G" switch does not actuate within a few seconds after the solenoid energizes the pinsetter will shut off and indicate an error.



(1) FREE PLAY WITH SWITCH CLOSED
(2) SWITCH "G"
(3) ADJUSTABLE SCREW
(4) SWEEP ATTENUATOR

Figure 2-4. Attenuator Down, Closing "G" Switch.

Error Code "G" Switch

G FOUND	65	SWITCH G IS NOT EXPECTED BUT FOUND
G NTFND	75	SWITCH G EXPECTED BUT NOT FOUND
Invld 0 - Invld 5	**90-95**	**INVALID MACHINE STATE**

Mechanic's Rear Control Switches (Standard on pinsetters)

A mechanic's rear control box mounted on the ball return side of the elevator for pinsetters equipped with the base or fixed guards. The box gives the mechanic operational control of the pinsetter. Three switches are located on this box:

1. **Set Switch -** This switch causes the machine to set the last known combination of pins.

2. **Reset -** This switch cycles the machine to the next ball.

3. **Stop/Run -** This switch turns off the machine. It must be in the stop position before entering the machine for service.

NOTE: *When the pinsetter is connected to Brunswick Frameworx scoring the reset switch will act like the set switch when the scorer is assigned to open play mode.*

These three switches are identical in function to the switches mounted on the top of the Nexgen box located on the front of the pinsetter.

(1) RUN/STOP TOGGLE SWITCH
(2) PLUGS INTO P3/P21 OF NEXGEN BOX

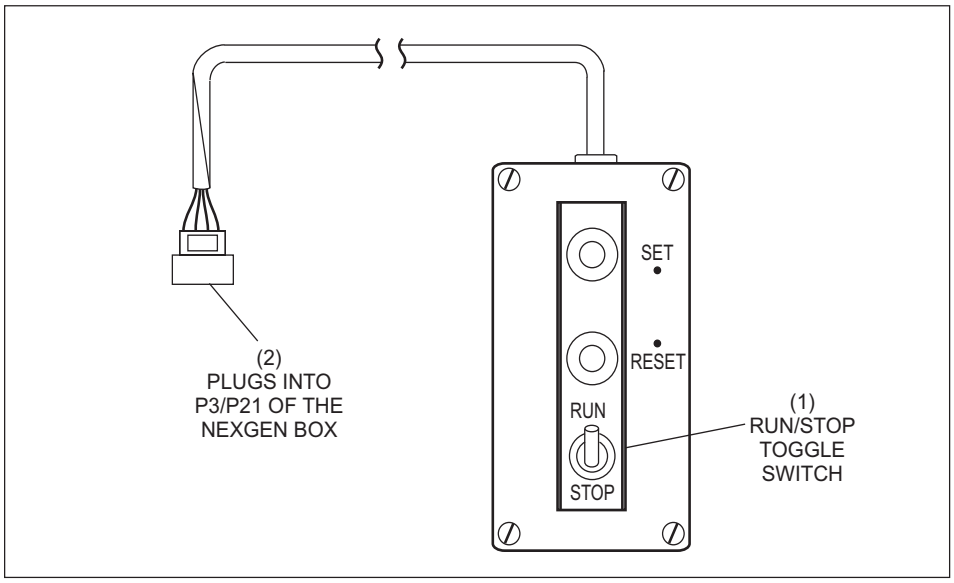


Figure 2-5. Mechanic's Rear Control Box.

Mechanic's Remote Display (Optional on pinsetters)

The mechanic's remote display box is mounted the back of left lane elevator for pinsetters equipped with the advanced guards. The box replaces the mechanic's control box and the display of the Nexgen electronics. The remote display box contains a display and keypad that gives the mechanic operational control of the Nexgen electronics and shows the pinsetters' mode and error codes. Set, reset, and stop/run switches for both pinsetters are also provided.

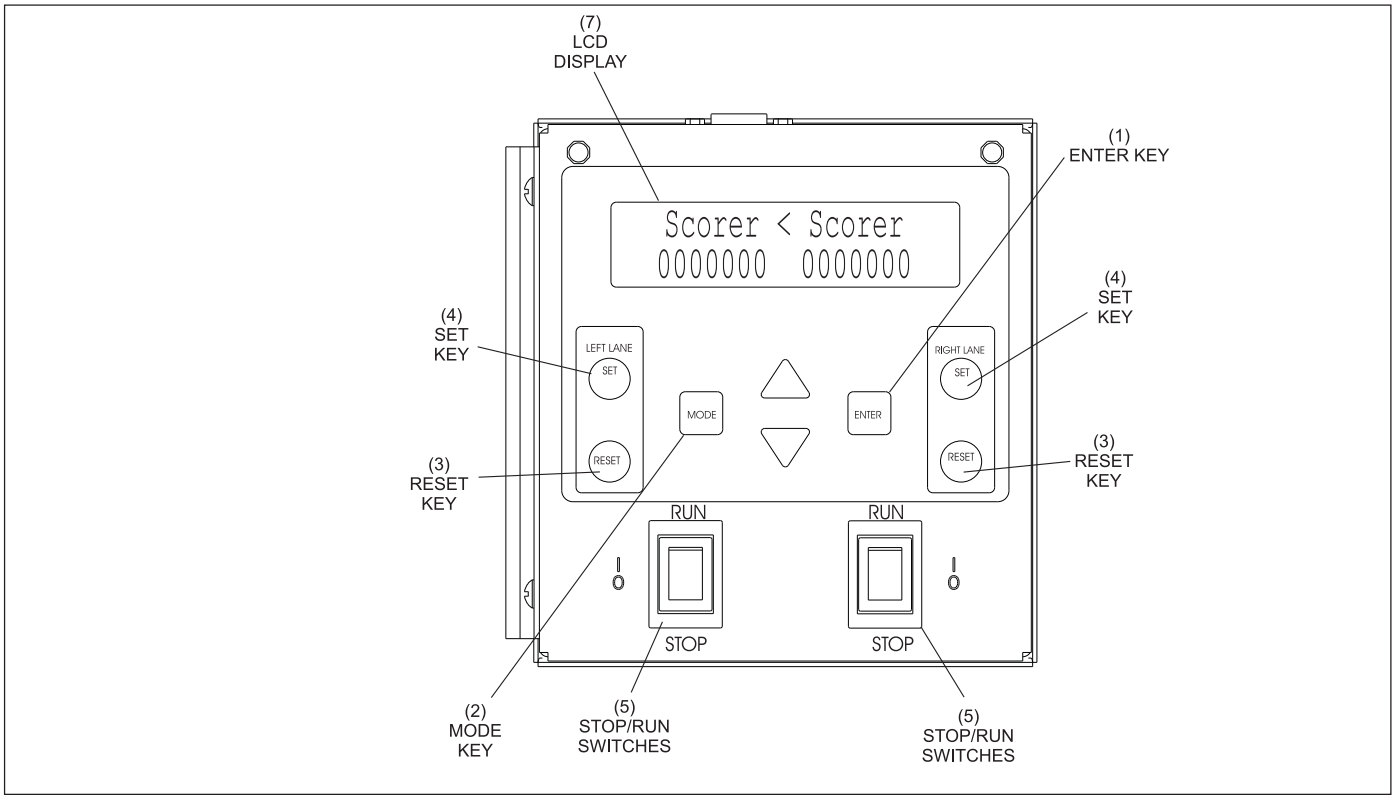


Figure 2-6 Mechanic's Remote Display

(1) **Enter Key -** This push button key has two functions. During pinsetter setup it is used to select the left or right lane. Once in a configuration mode , it is used to display the different options for the selected mode.

(2) **Mode Key -** This push button key allows the mechanic to select the pinsetter setup, troubleshooting, or operational modes

(3) **Reset Keys** - These push button keys cause the pinsetter to cycle to the next ball.

(4) **Set Keys** - These push button keys causes the last combination of pins to be set.

(5) **Stop/Run Switches** - This switch is used to turn the pinsetter on/off

(6) **Up/Down Arrow Keys -** These push button keys allow the mechanic to toggle through the pinsetter modes or select options when in a mode.

(7) **LCD Display -** This display shows the frame count, error codes and setup information for both pinsetters.

Out-Of-Range Switch

The “OOR” switch is located on the right hand guide tower. The purpose of this switch is to inform the Pinsetter CPU if the table was lowered to the normal detecting height. If a pin has moved out of range, the table will land on top of the pin causing the table to stop short of the switch. The setting table will return home and the pinsetter will turn off. The mechanic must then turn the Stop/Run switch off, clear any deadwood from the pin deck, and then turn the Stop/Run switch back to the Run position. If the pinsetter is connected to Brunswick scoring a score correction must also be entered before the pinsetter will turn on

NOTE: *The out of range function can be disable through the scoring system. For Brunswick Frameworx scorers when the lane is assigned to open play mode the scorer will not score and the pinsetter will respot the original combination of pins so that the bowler can bowl again. With Vector scorers disabling the OOR function will cause a score of 0 and cause the pinsetter will leave the existing pins on the pindeck for the bowler to throw at.*

NOTE: *The Out-Of-Range function can also be disabled through the Nexgen electronics for centers that do not have automatic scoring..*

(1) OUT-OF-RANGE CAM
(2) OUT-OF-RANGE SWITCH
(3) RIGHT-HAND TOWER ASSEMBLY
(4) RIGHT-HAND TABLE TUBE
(5) TABLE LIFT CHAIN

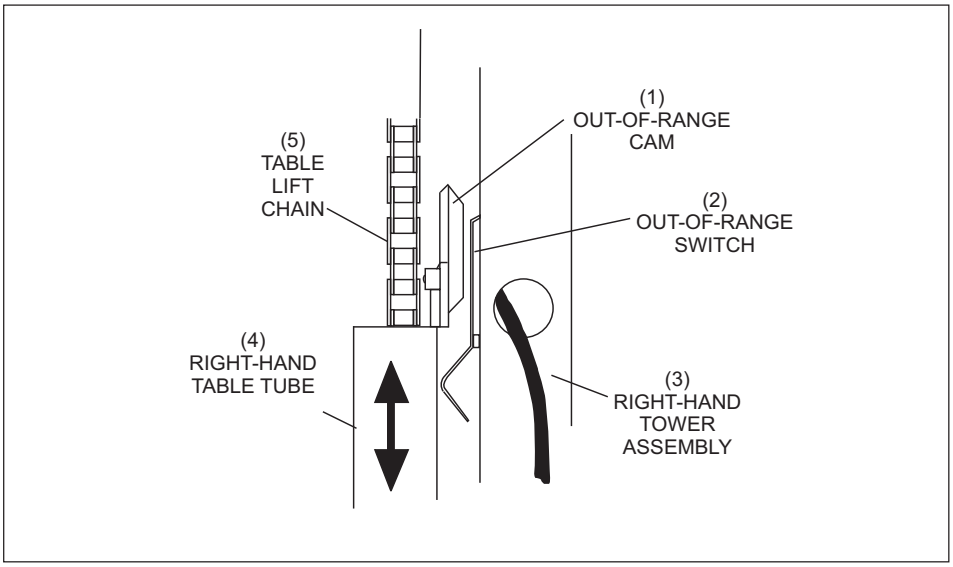


Figure 2-7. Out-Of-Range Switch.

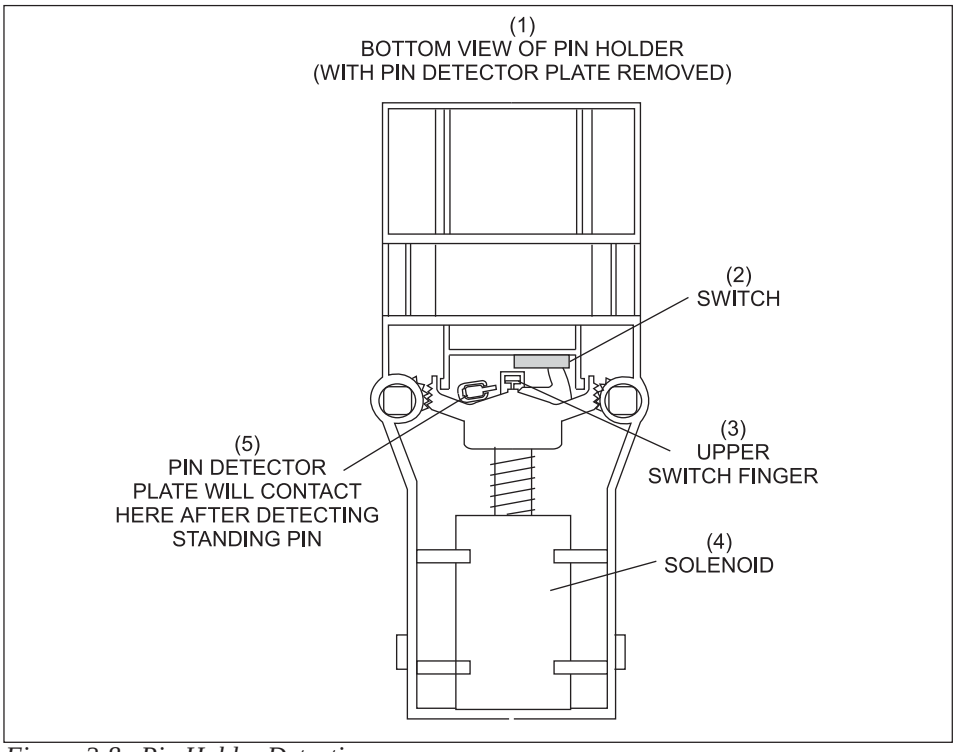
Error Code “OOR” Switch

OOR Found	67	SW. OOR WAS NOT EXPECTED BUT WAS FOUND
Pin OOR	PO	OUT OF RANGE PIN DETECTED (OOR SW DID NOT CLOSE BEFORE THE “B” SWITCH

Pin Holder Switches

The setting table has ten pin holders. Each pin holder has a single switch that is used for two purposes. The switch will be actuated by the pin dropping into the holder from a pin station. The switch can also be activated by the pin detector plate being pushed up during detection of a standing pin.

During operation, the Pinsetter CPU "memorizes" the pin holders' switch positions as the table starts to lower. When the table reaches the "B" switch position, the Pinsetter CPU will read the switches again. If a pin is already loaded into the pin holder, the detection of a standing pin will cause the switch to reopen. When detecting a standing pin without a pin loaded into the pin holder, the switch will close. A change to the state of the switches allows the CPU to determine which pins, if any, are standing on the pin deck. The CPU uses this information to determine how to complete the cycle and what score to send to the scorer (if installed).



(1) BOTTOM VIEW OF PIN HOLDER (WITH PIN DETECTOR PLATE REMOVED)
(2) SWITCH
(3) UPPER SWITCH FINGER
(4) SOLENOID
(5) PIN DETECTOR PLATE WILL CONTACT HERE AFTER DETECTING STANDING PIN

Figure 2-8. Pin Holder Detecting.

Error Codes - Pin Loading and Detecting

Pin1Id - Pin10Id	01-10	PIN LOADING TIME-OUT
Detect 1 - Detect 10	50-59	PIN NOT DETECTED IN DIAGNOSTICS

Spotting Tong Switch (ST)

The “ST” switch is located on the right side of the setting table. A cam on the toothed rack that drives the spotting tongs will activate (close) the switch when the spotting tongs are open. This information used to determine if it is ok to lower the setting table at the start of a cycle.

(1) RIGHT-HAND SQUARE SHAFT
(2) CAM
(3) SPOTTING TONG SWITCH
(4) TOOTHED RACK

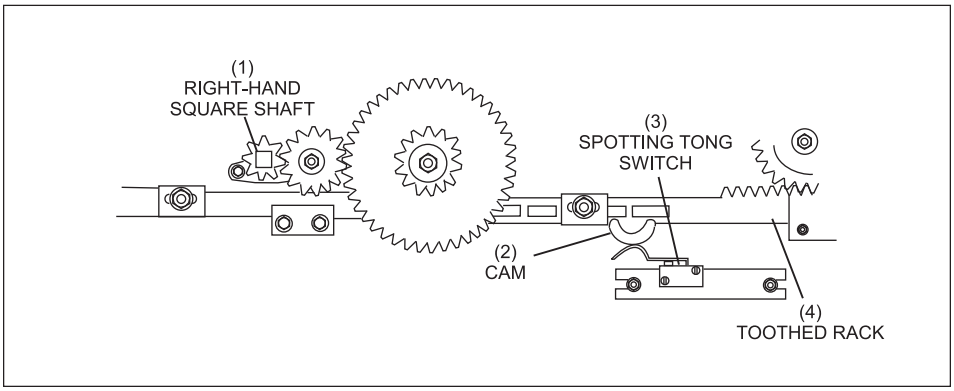


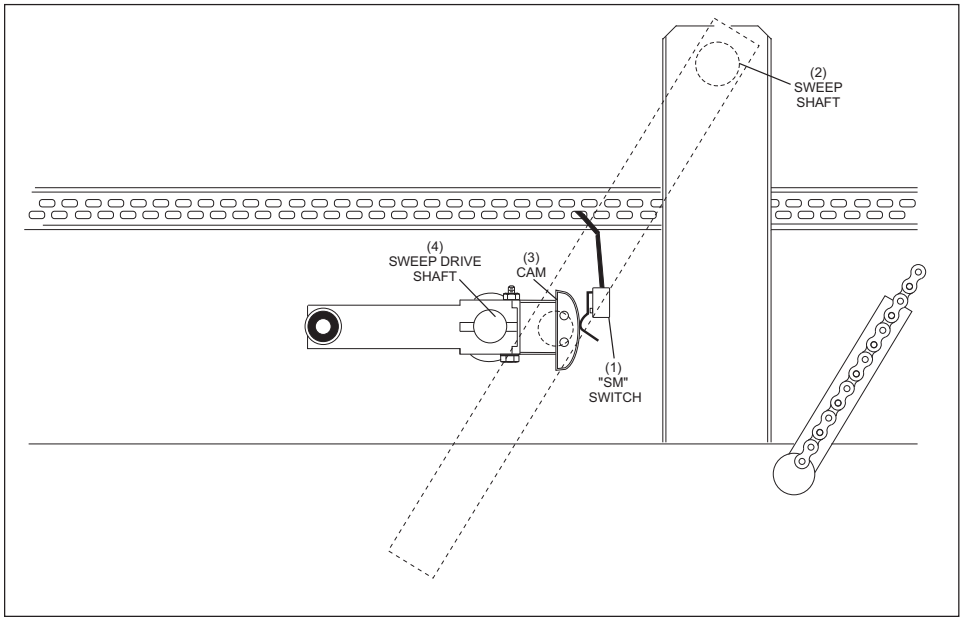
Figure 2-9. ST Switch with Tongs Open.

Error Codes “ST” Switch

ST Found	66	SWITCH ST NOT EXPECTED BUT FOUND
ST Ntfnd	76	SWITCH ST EXPECTED BUT NOT FOUND
Invld 0 - Invld 5	**90-95**	**INVALID MACHINE STATE**

Sweep Motor Switch (SM)

The “SM” switch is mounted on the front right side of the pinsetter. A cam mounted on the sweep crank arm actuates (closes) the switch when the sweep wagon is all the way forward. Activating this switch turns the sweep motor off allowing the motor’s internal brake to stop the sweep. The switch must be closed in order for the table motor to run.



(1) “SM” SWITCH
(2) SWEEP SHAFT
(3) CAM
(4) SWEEP DRIVE SHAFT

Figure 2-10. SM Switch.

Error Codes “SM” Switch

SM Found	64	SWITCH SM NOT EXPECTED BUT FOUND
SM Ntfnd	74	SWITCH SM EXPECTED BUT NOT FOUND
Invld 0 - Invld 5	**90-95**	**INVALID MACHINE STATE**

TS-1 Switch

The “TS-1” table jam switch is mounted on the back left side of the pinsetter frame near the 7 pin. The switch is activated only when the pin holders are unable to return to the horizontal position after setting new pins. A roller on the rear swing shaft of the setting table overpowers a spring tensioned actuator arm to close this switch. Once this switch is actuated, the table motor will reverse the table for 1.5 seconds or until the “C” switch is closed. An error code “J1” or “TS1 Jam” will appear on the error display and the status light will flash. The mechanic can then turn the stop/run switch of the machine to the stop position and clear the jam. Once the jam has been cleared, simply turn the stop/run switch to the run position to continue machine operation.

(1) TS-1 TABLE JAM SWITCH
(2) PIN HOLDER
(3) REAR SWING SHAFT
(4) ROLLER
(5) ACTUATOR ARM
(6) ADJUSTMENT BOLTS

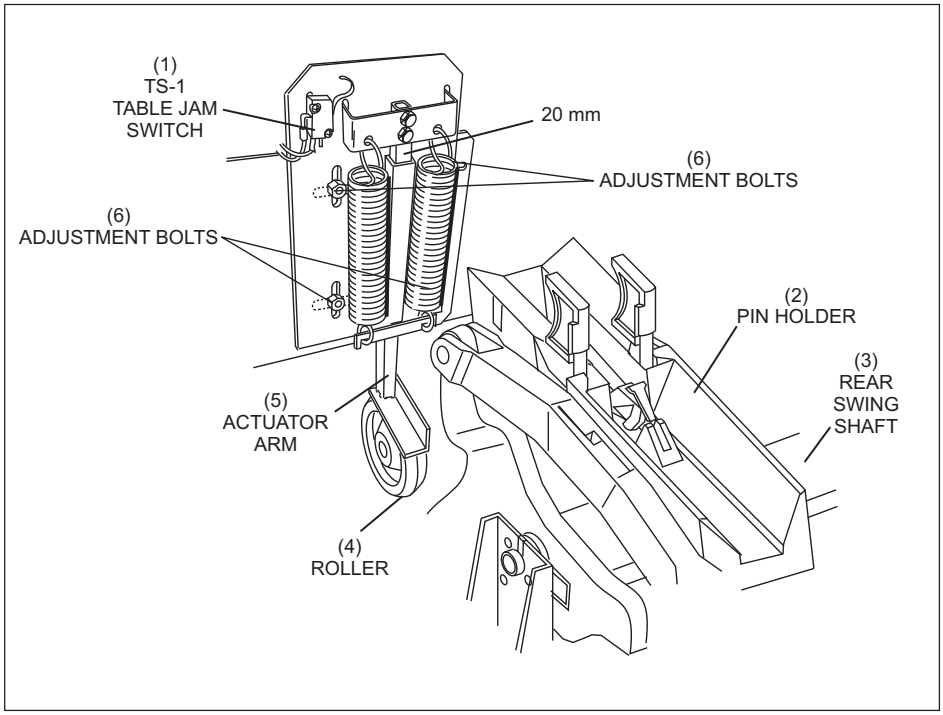


Figure 2-11. TS-1 Table Jam Switch.

Error Code

TS1 Jam	J1	JAM SWITCH TS1 (FOUND)

TS-2 Switch

This table jam switch is mounted inside the right side frame near the switch cluster. This is a jam switch that is activated only when the table is not able to return to its up home position. If a pin or broken part becomes wedged between the top of the setting table and the bottom of the distributor, the table is prohibited from rising. As the table crank continues to turn, additional torque causes the chain sprocket and shaft to overpower a tension spring attached to the actuator lever. Any time this switch is closed, the table motor will reverse the table for 1.5 seconds or until the "C" switch is closed. The machine will shut off, an error code "J2" or TS2 JAM will appear on the error code display and the status light will flash.

Turn the Stop/Run switch to the Stop position and clear the jam. Once the jam has been cleared, turn the stop/run switch to the run position.

(1) TS2 TABLE JAM SWITCH
(2) RIGHT GUIDE TOWER
(3) ACTUATOR LEVER
(4) TENSION SPRING
(5) SPROCKET SHAFT

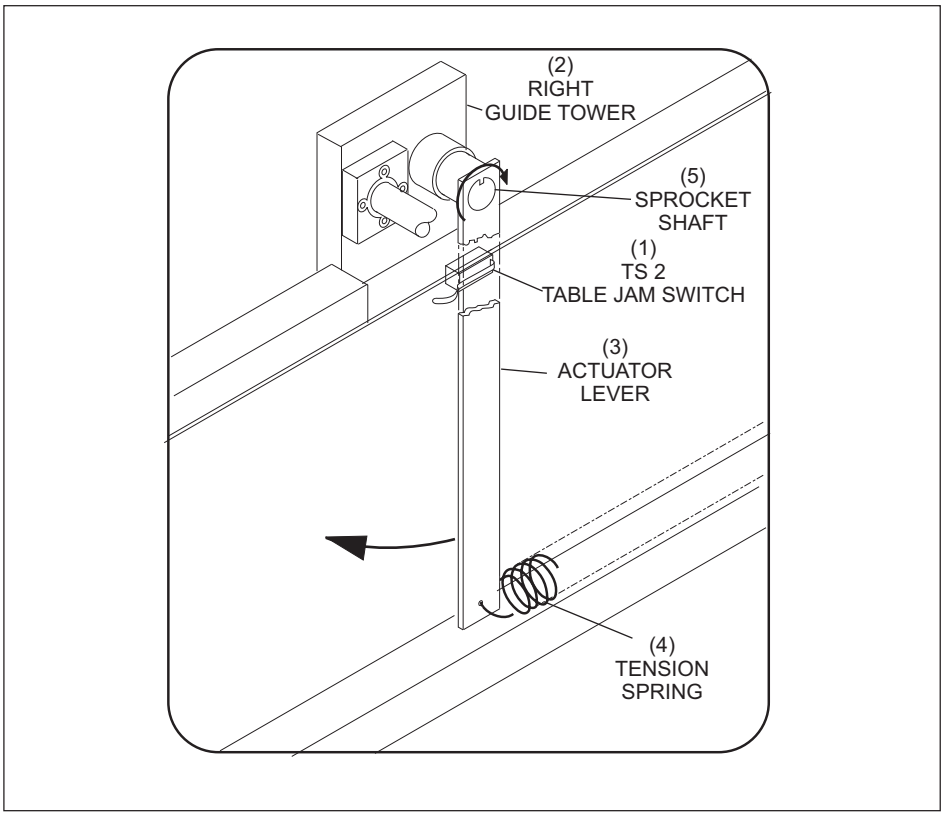


Figure 2-12. TS-2 Table Jam Switch.

Error Code

TS2 Jam	J2	JAM SWITCH TS2 (FOUND)

Pin Count Switch

This switch is mounted on the top of the Elevator. The switch is positioned to count each pin as it leaves the elevator and enters the shark assembly. The switch information is sent to the pinsetter electronics where it is used to determine when to energize the shark solenoid.

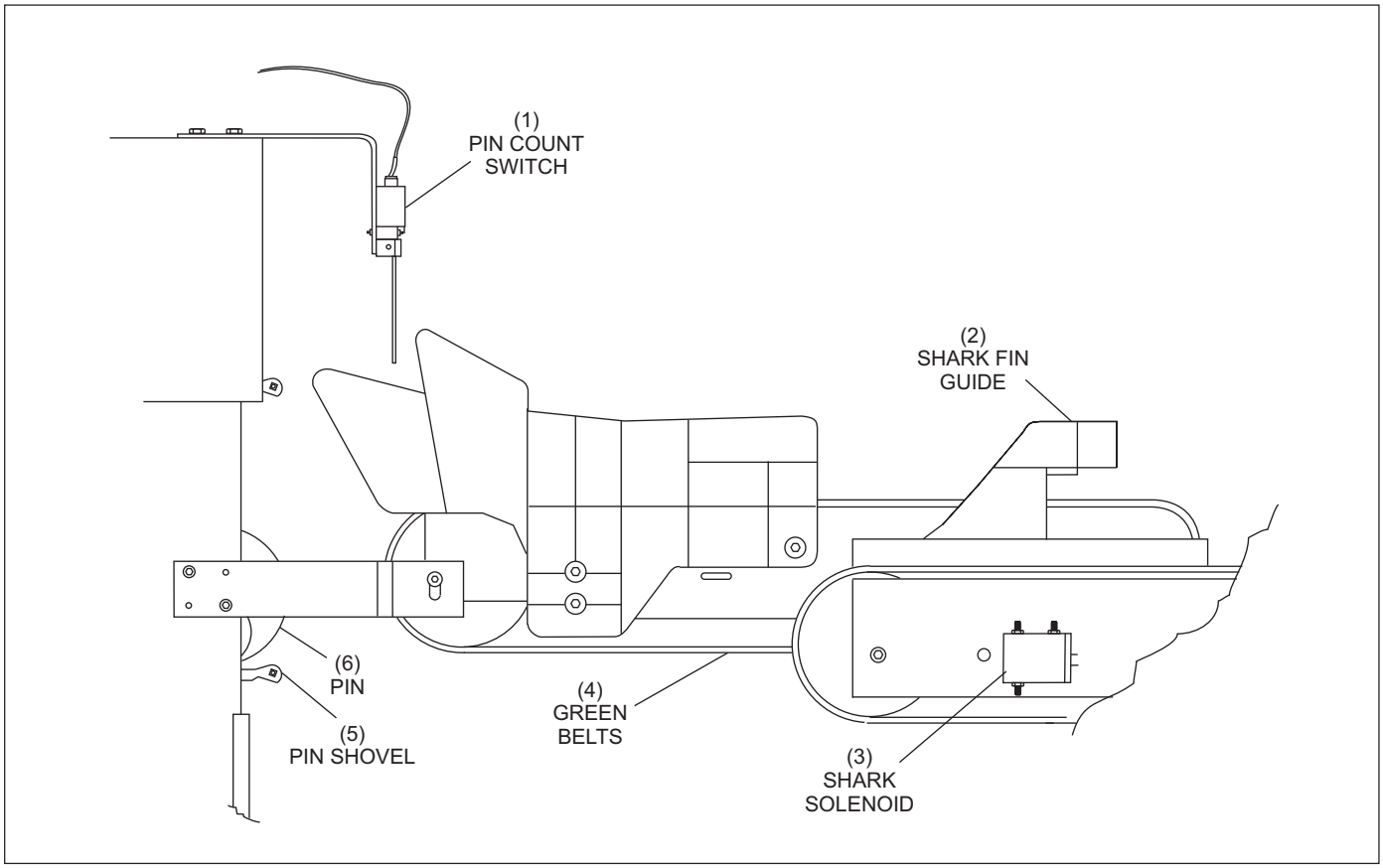


Figure 2-13. Pin Count Switch and Shark Solenoid.

(1) PIN COUNT SWITCH
(2) SHARK FIN GUIDE
(3) SHARK SOLENOID
(4) GREEN BELTS
(5) PIN SHOVEL
(6) PIN

Error Code

Pin cnt	EL	PIN COUNT SWITCH SHORTED FOR AT LEAST 5 SECONDS
Pin Ld3, Pin Ld6, Pin Ld9, or Pin Ld10	03, 06, 09, OR 10	PIN COUNT SWITCH WIRES OPEN

Emergency Off Switches (Base and Fixed Guards)

The Base and Fixed guard packages contain three emergency stop switches that allow the operator to quickly shut down power to both pinsetters on a lane pair by removing main power to the Nexgen box. Once an emergency stop switch has been pressed, the pinsetters cannot be restarted until the switch is returned to its closed position by twisting its actuator button and the Nexgen power fail (PF) error code is cleared using a Stop/Run switch located on the rear mechanic's box or Nexgen display.

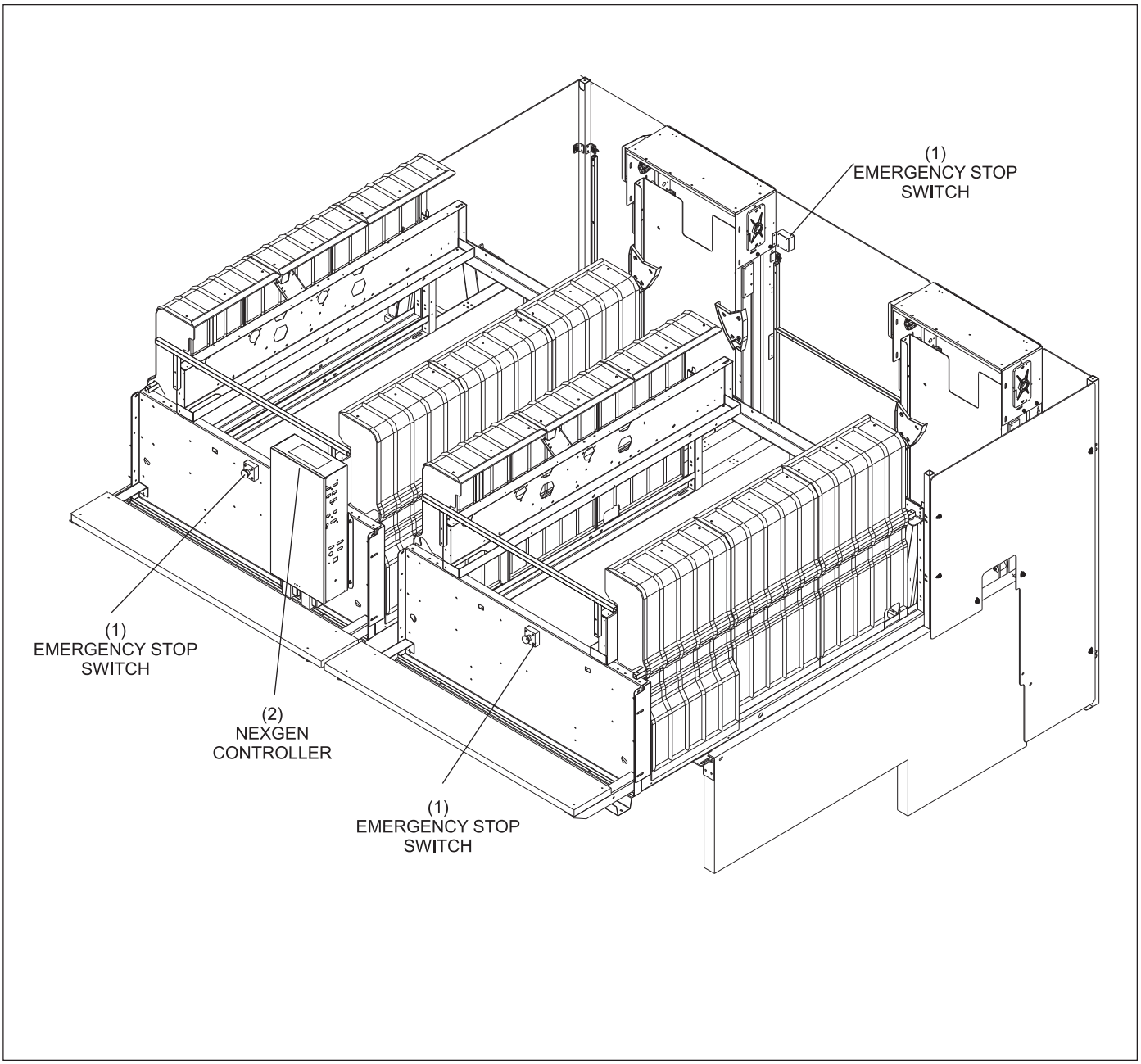


Figure 2-14. Emergency Stop Switches - Base and Fixed Guarding

(1) EMERGENCY STOP SWITCH (2) NEXGEN CONTROLLER

Solenoids

Two types of solenoids are used on the GS-Series pinsetter. The black colored solenoids are intermittent duty type solenoids. This type of solenoid is pulsed only for a brief amount of time. The red colored solenoids are continuous duty type solenoids. This type of solenoid can be energized for up to 90 seconds at a time, if necessary.

NOTE: *When working properly, the black function solenoid coils will have 12 ohms of resistance while the red solenoid coils will have 26 ohms of resistance.*

When troubleshooting solenoids, a reading on the multimeter of 0 ohms indicates that the solenoid has shorted out and is defective. A reading of infinity (no reading) indicates that the coil is opened and defective.

When changing a solenoid, always use a solenoid of the same duty type. Do not use a black colored solenoid in place of a red colored solenoid.

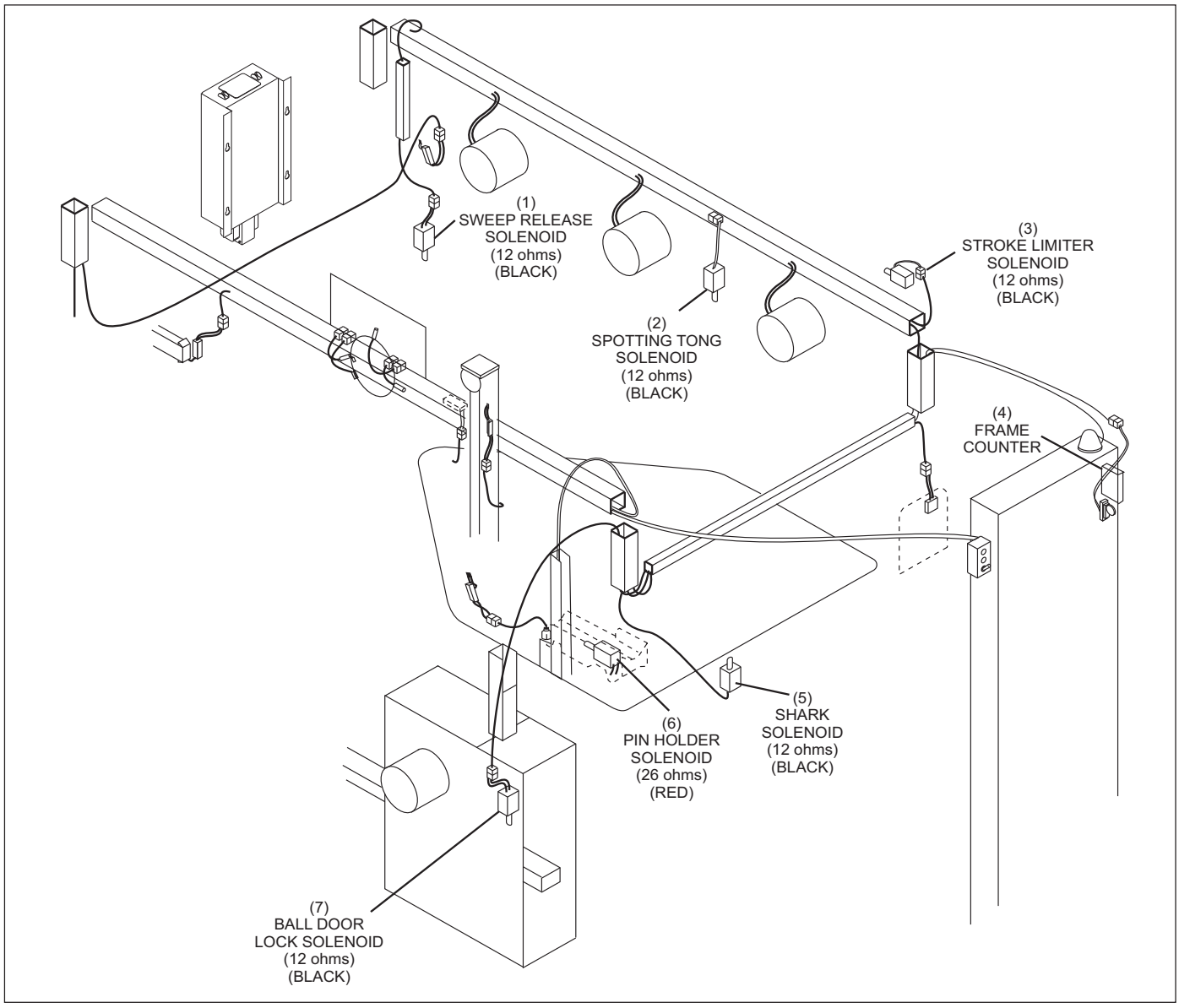
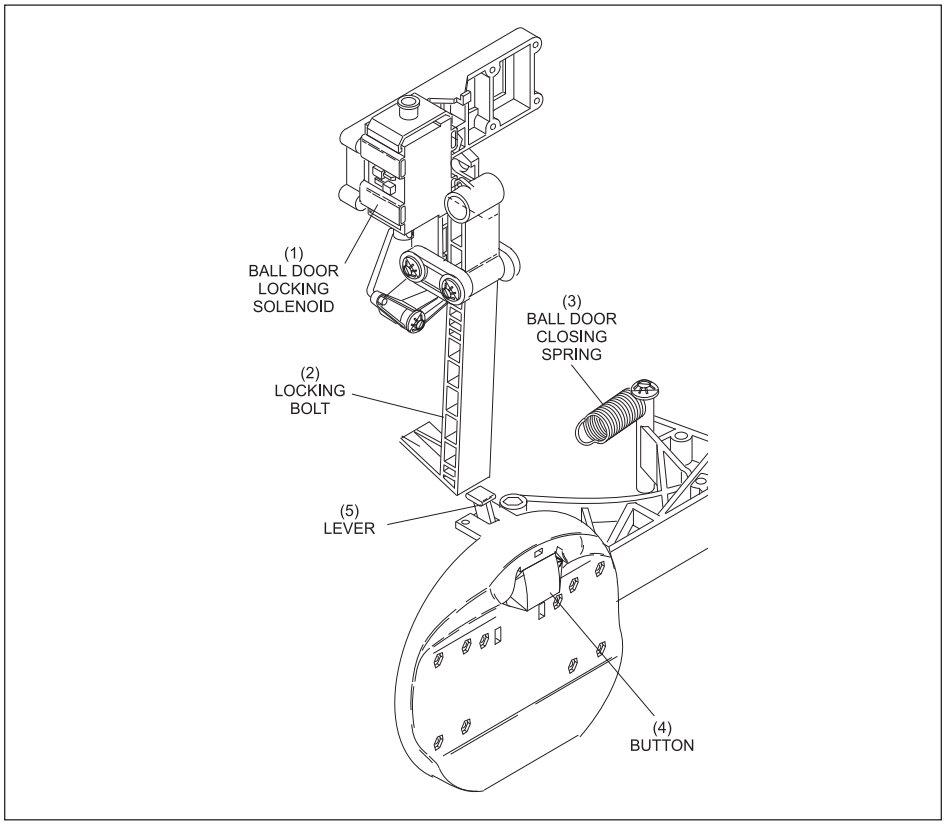


Figure 2-15. Solenoids.

(1) SWEEP RELEASE SOLENOID (12 OHMS) (BLACK)
(2) SPOTTING TONG SOLENOID (12 OHMS) (BLACK)
(3) STROKE LIMITER SOLENOID (12 OHMS) (BLACK)
(4) FRAME COUNTER
(5) SHARK SOLENOID (12 OHMS) (BLACK)
(6) PIN HOLDER SOLENOID (26 OHMS) (RED)
(7) BALL DOOR LOCK SOLENOID (12 OHMS) (BLACK)

Ball Door Solenoid

The ball door solenoid is used to prevent the ball door from opening for a period of three or four seconds after ball detection. Energizing the solenoid lowers the locking bolt so that it will block the door lever even if the ball door button is pressed.



(1) BALL DOOR LOCKING SOLENOIDS
(2) LOCKING BOLT
(3) BALL DOOR CLOSING SPRING
(4) BUTTON
(5) LEVER

Figure 2-16. Ball Door Solenoid.

Sweep Release Solenoid

The purpose of the sweep release solenoid is to actuate the sweep release mechanism. This allows the tipper to pivot and the sweep wagon to drop from its up "home" position to the guarding position. The solenoid is energized immediately when a ball passes through the ball detector's beam or someone presses a "set" or "reset" button.

(1) ATTENUATOR
(2) "G" SWITCH
(3) SWEEP WAGON
(4) SWEEP RELEASE SOLENOID
(5) TIPPER

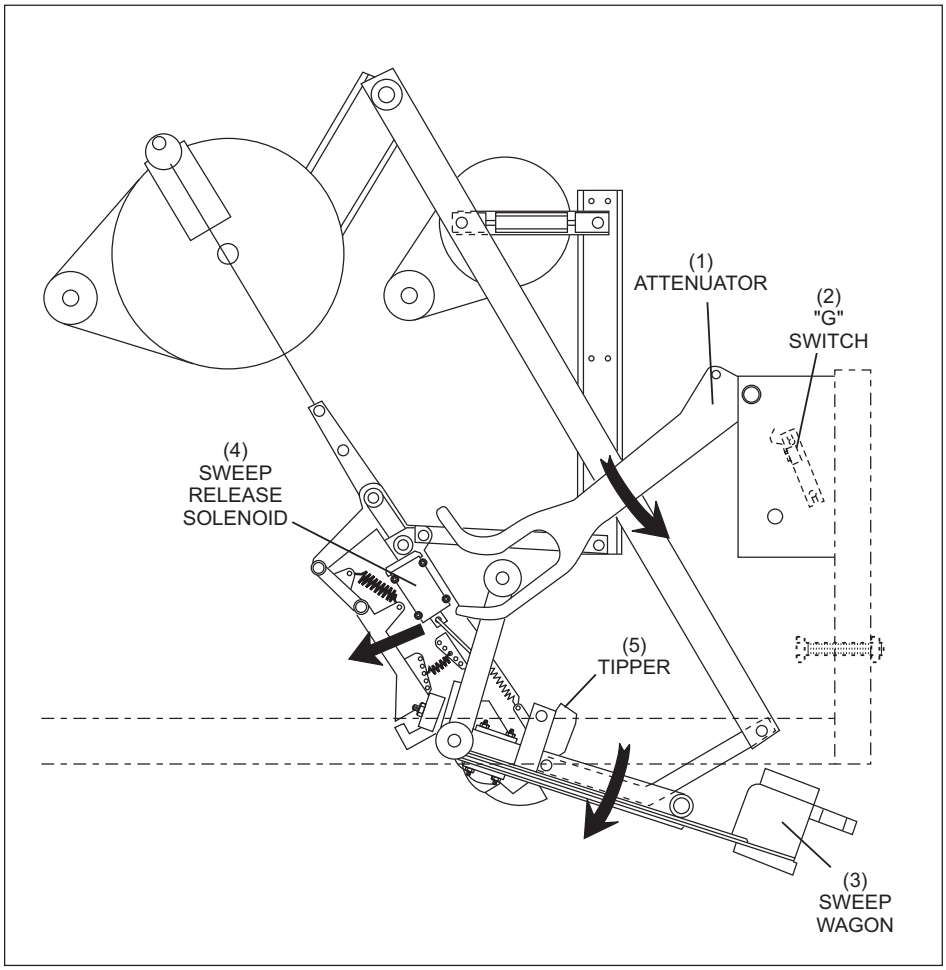
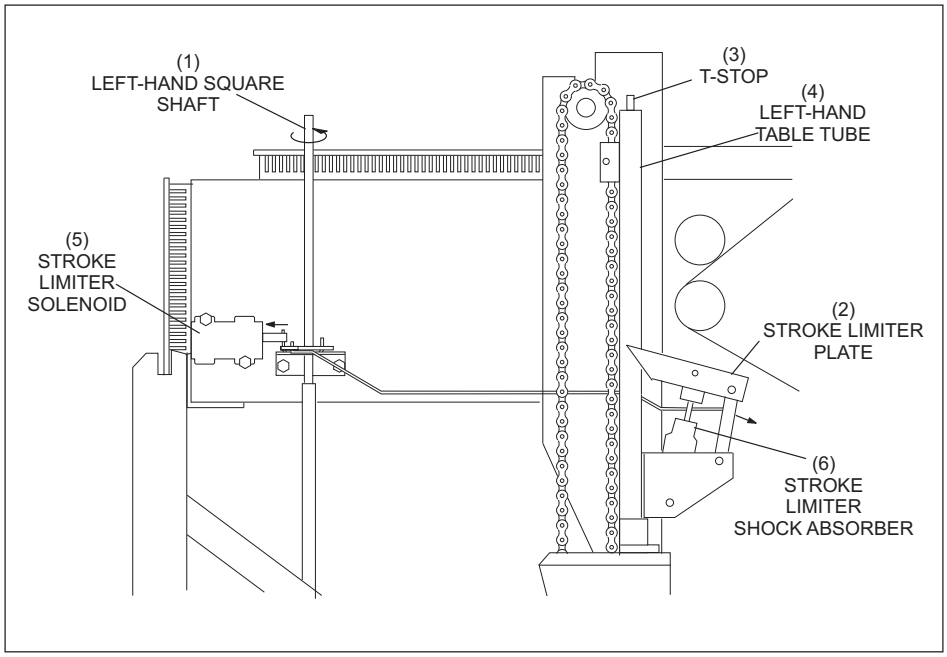


Figure 2-17. Sweep Release Solenoid.

Stroke Limiter Solenoid

The purpose of the stroke limiter solenoid is to allow the table to lower to the pindeck to set new pins. When energized it briefly pulls the stroke limiter plate away from the table tube allowing the T-stop to clear the stroke limiter plate and the table to lower fully to the pin deck. It also turns the left-hand square shaft, releasing the pin holder's swing shaft latch to allow the pin holders to rotate vertical as the table is lowered.



(1) LEFT-HAND SQUARE SHAFT
(2) STROKE LIMITER PLATE
(3) T-STOP
(4) LEFT-HAND TABLE TUBE
(5) STROKE LIMITER SOLENOID
(6) STROKE LIMITER SHOCK ABSORBER

Figure 2-18. Stroke Limiter Solenoid.

Spotting Tong Solenoid

The spotting tong solenoid engages a gear clutch assembly with the table drive to close or reopen the spotting tongs depending on which direction the table motor is turning. The gear clutch assembly rotates a spindle shaft and through a helical gear drives the right-hand square shaft. When the main table drive shaft and right-hand square shaft are turning counterclockwise, the spotting tongs close. When they are turning clockwise, the spotting tongs open.

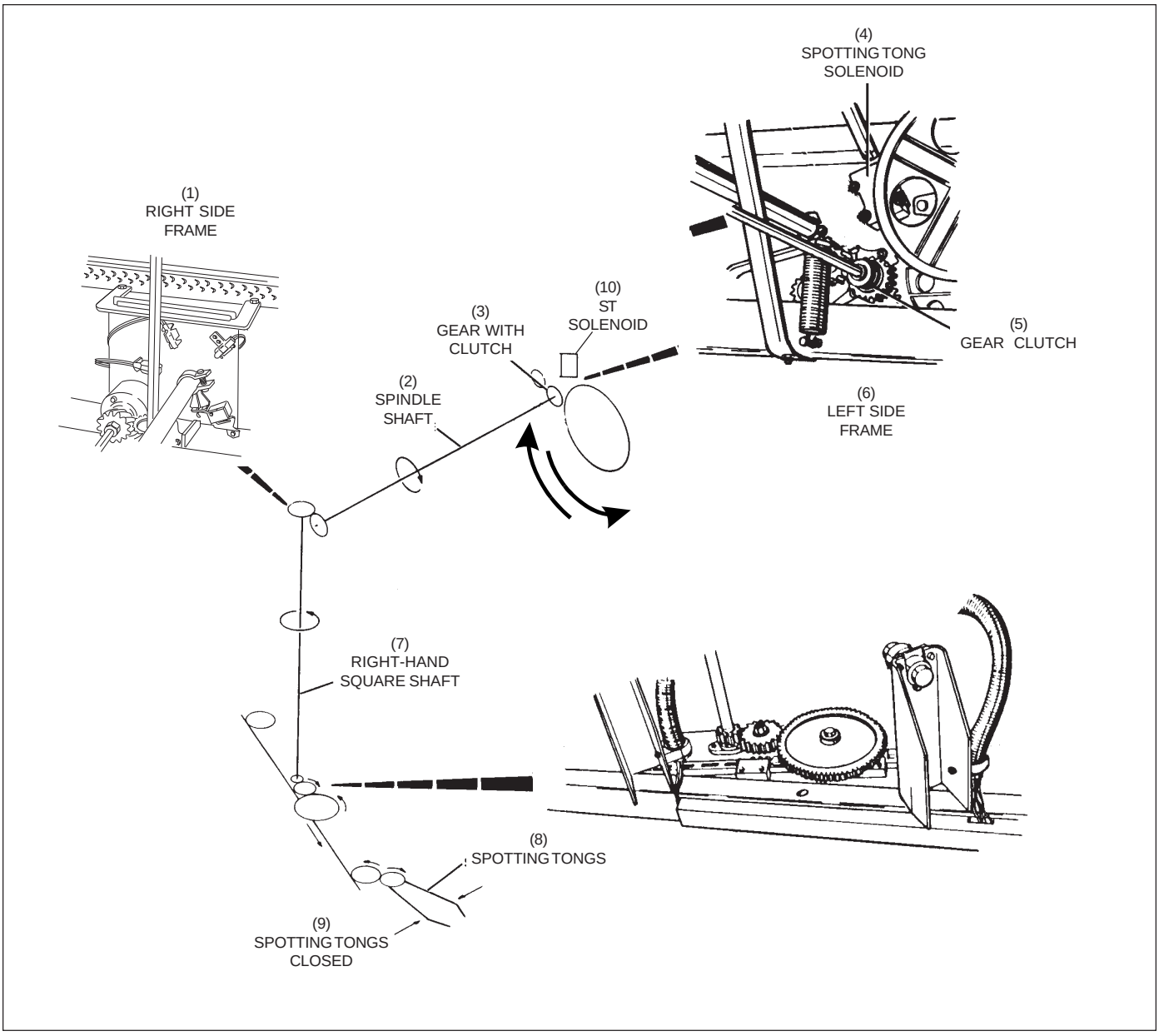


Figure 2-19 Spotting Tong Drive.

(1) RIGHT SIDE FRAME
(2) SPINDLE SHAFT
(3) GEAR WITH CLUTCH
(4) SPOTTING TONG SOLENOID
(5) GEAR CLUTCH
(6) LEFT SIDE FRAME
(7) RIGHT-HAND SQUARE SHAFT
(8) SPOTTING TONGS
(9) SPOTTING TONGS CLOSED
(10) ST SOLENOID

Pin Holder Solenoids

The red solenoid on the pin holder energizes to open the grippers allowing pins in or out of the holder. When the table is on its way up to the home position, the grippers can open to load the pins. When the table is down, the grippers open to release a new set of pins onto the pin deck.

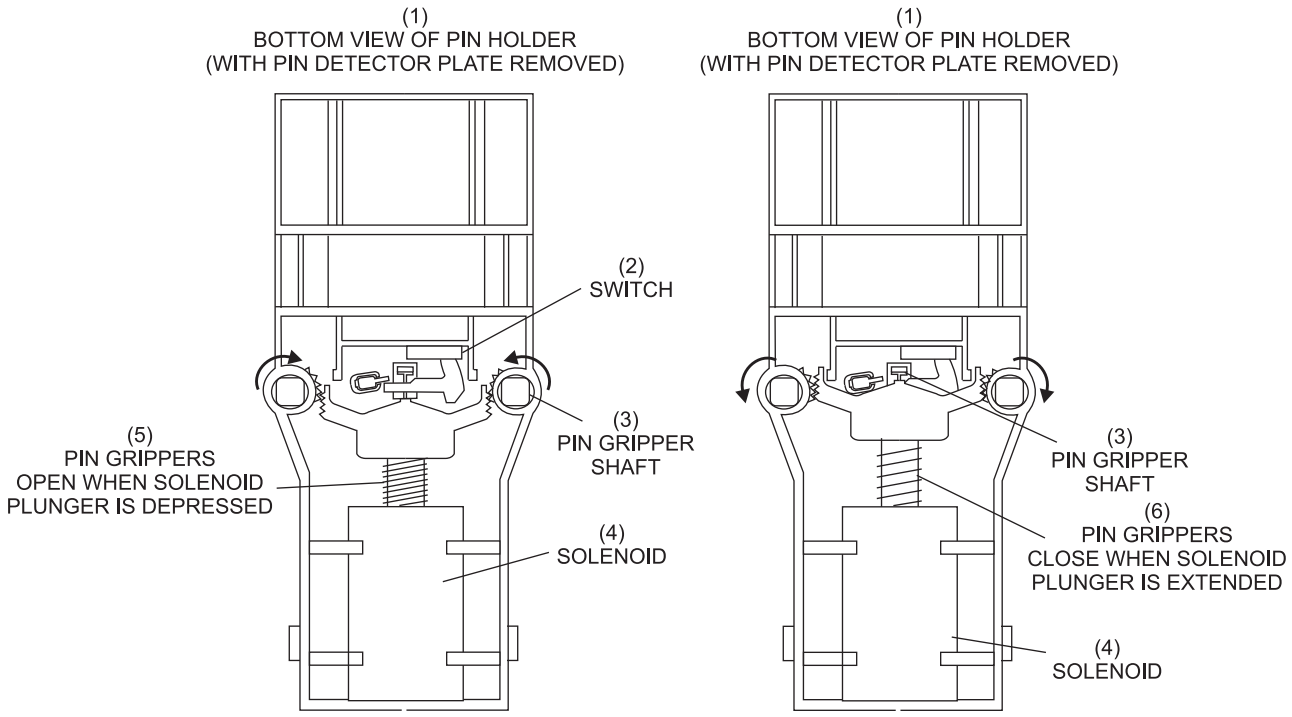


Figure 2-20. Pin Holder Horizontal - Up for Loading Pins.

(1) BOTTOM VIEW OF PIN HOLDER (WITH PIN DETECTOR PLATE REMOVED)
(2) SWITCH
(3) PIN GRIPPER SHAFT
(4) SOLENOID
(5) PIN GRIPPERS OPEN WHEN SOLENOID PLUNGER IS DEPRESSED
(6) PIN GRIPPERS CLOSE WHEN SOLENOID PLUNGER IS EXTENDED

Shark Solenoid

This solenoid is used to control the Shark Fin guide. Energizing the solenoid will cause the pin guide to flip left to direct the pin onto the right side of the distributor. When the solenoid is de-energized, a return spring pulls the guide back to it original position deflecting pins to the left distributor lanes. The pins are deflected in a (L-R-L-L-R-L-R-L-L-R) pattern. The “R” designation is for the 10 pin or right hand side of the pinsetter. The “L” designation is for the “7” pin or the left side of the pinsetter. The electronics determined when to energize the solenoid based on the signal coming from the pin count switch.

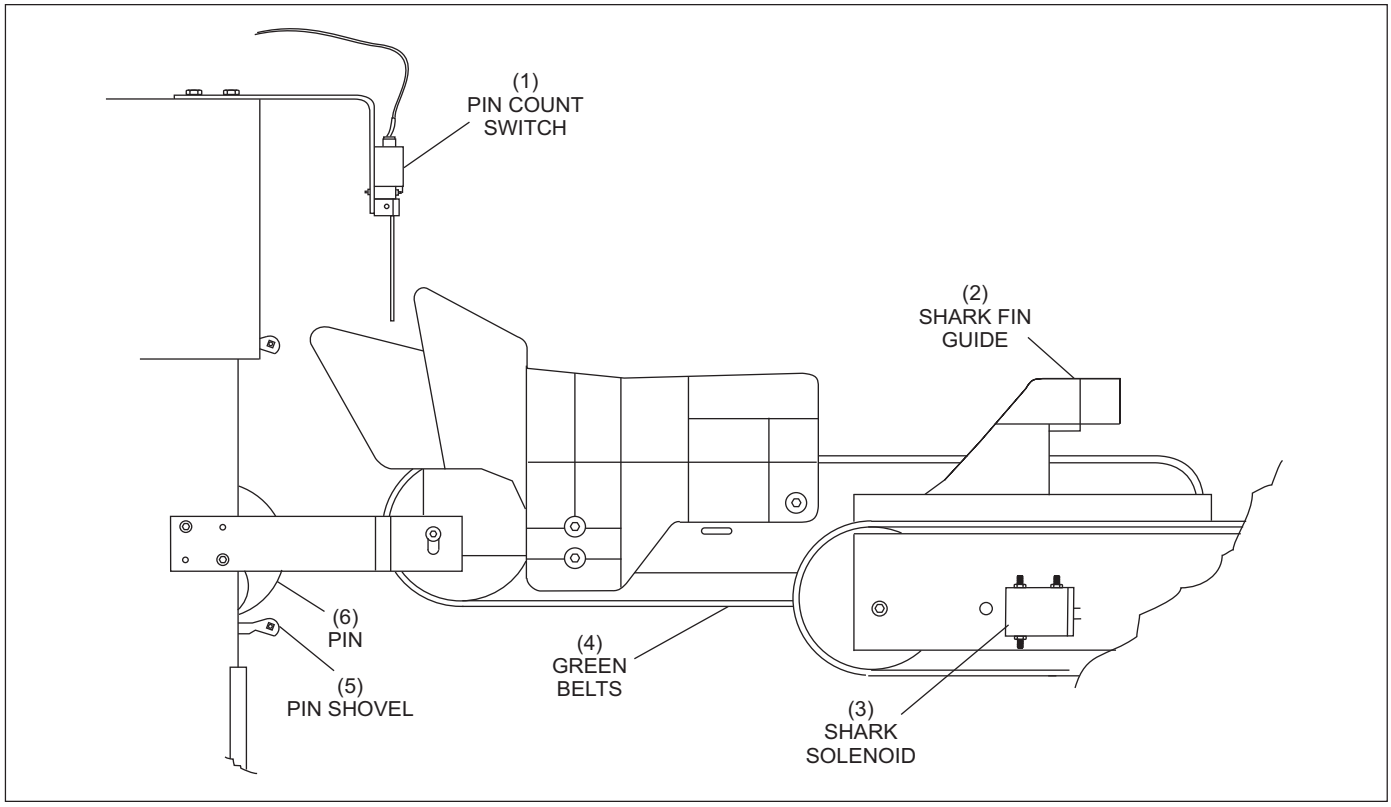


Figure 2-21. Shark Solenoid

(1) PIN COUNT SWITCH
(2) SHARK FIN GUIDE
(3) SHARK SOLENOID
(4) GREEN BELTS
(5) PIN SHOVEL
(6) PIN

Motors

All motors used on the GS-Series Pinsetters are three phase motors capable of working at 208VAC, 230VAC, or 380VAC and with either 50 or 60 hertz. For proper wiring and pulley installation information when replacing a motor, see the "Service" section of this manual.

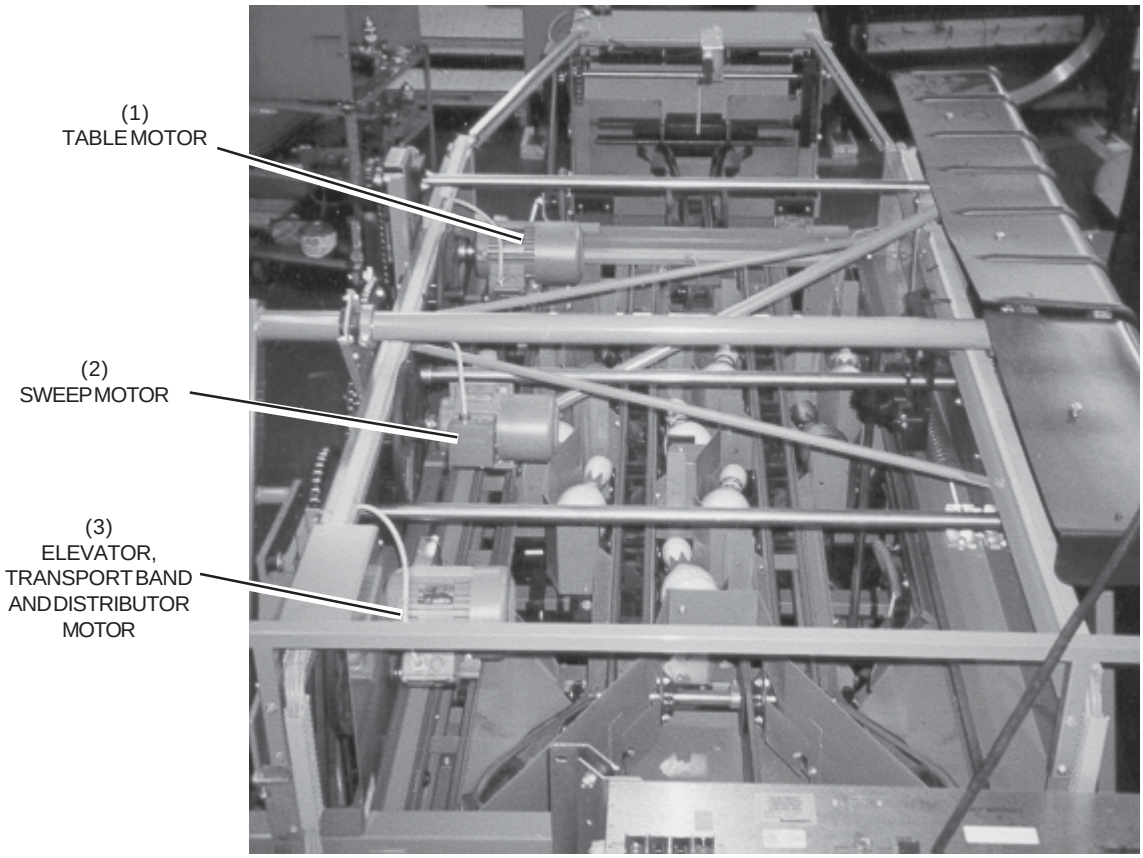


Figure 2-22. Pinsetter Motors.

(1) TABLE MOTOR

(2) SWEEP MOTOR

(3) ELEVATOR, TRANSPORT BAND AND DISTRIBUTOR MOTOR

(4) FRONT OF PINSETTER

Distributor Motor

The distributor motor is a 1/2 horsepower (hp) motor located at the front left corner of the pinsetter. It drives everything that moves pins around the machine including; the round belts of the distributor, the shovels in the elevator, and the transport band in the pit area. This motor typically runs for 45 seconds once the pinsetter cycles. If no additional ball detect or reset occurs within that time frame, the motor will turn off and wait until a ball is detected. If the table is waiting for pins, the motor will run up to 90 seconds. If the pins are not received by the pinholders within 90 seconds, the machine stops with a pin load error indicating what pin(s) did not load. Refer to *Figure 2-22*.

Sweep Motor

The sweep motor is a 1/4 hp motor located at the center left-hand side of the pinsetter. It drives the sweep rearward and forward to clear pins off the pin deck. This motor has an internal brake that prevents coasting when power is turned off to the motor. Refer to *Figure 2-22*.

Table Motor

The table motor is a 1/2 hp motor at the rear left-hand side of the pinsetter. Its functions are to raise and lower the table, close and open the spotting tongs and raise the sweep at the end of a cycle. This motor runs both clockwise and counterclockwise to operate the tongs and raise the sweep when appropriate. The motor has an internal brake that locks onto the shaft when the motor is turned off. The brake holds the table up in the raised position. Refer to *Figure 2-22*.

WARNING!

Removing the setting table motor's V-belt can cause the setting table to fall and crash to the pindeck, possible causing damage or injury. Always lower the setting table fully to the pindeck BEFORE removing the setting table motor V-belt.

Ball Accelerator Motor

The ball accelerator motor is incorporated into the rear accelerator drum. It runs continuously at full speed when either one or both pinsetters is in operation. An internal overload is monitored by the Nexgen electronics through the "AS" cable. In the event of an overload situation the pinsetters will shut off and a "BA" or "Ball Acel" code will display.

CONTENTS

Section 3: Nexgen Electronics

General Information 3-3
Nexgen Controller Box 3-5
Left Side (Pinsetters with Advanced Guards) 3-5
Right Side (Pinsetters with Advanced Guards) 3-7
Bottom (All Nexgen Controller Boxes) 3-9
Internal 3-11
I/O PCBs 3-12
CPU PCB 3-13
High Voltage PCB 3-16
Machine Setup 3-18
LCD Display/User Interface 3-18
Diagnostic Modes 3-22
Trouble Diagnostics 3-22
Contact Closure Diagnostics (Switch Diagnostics) 3-22
Machine Cycle Diagnostics 3-22
Using the Diagnostics 3-23
Contact Closure Diagnostics (Switch Diagnostics) 3-23
Machine Cycle Diagnostics 3-24
Related Electronics 3-27
Ball Detect - Photocell Triggering 3-27
Foul Detect 3-28
Reset Button 3-28
Safety Power Controller 3-28
Safety Controller Codes 3-30
Cables and Wiring 3-32
Cable Connections 3-32

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Section 3: Nexgen Electronics

GENERAL INFORMATION

The Nexgen electronic system consists of one control box mounted on the front of the left pinsetter and several other items that monitor and help the pinsetter operate. *Figure 3-1.*

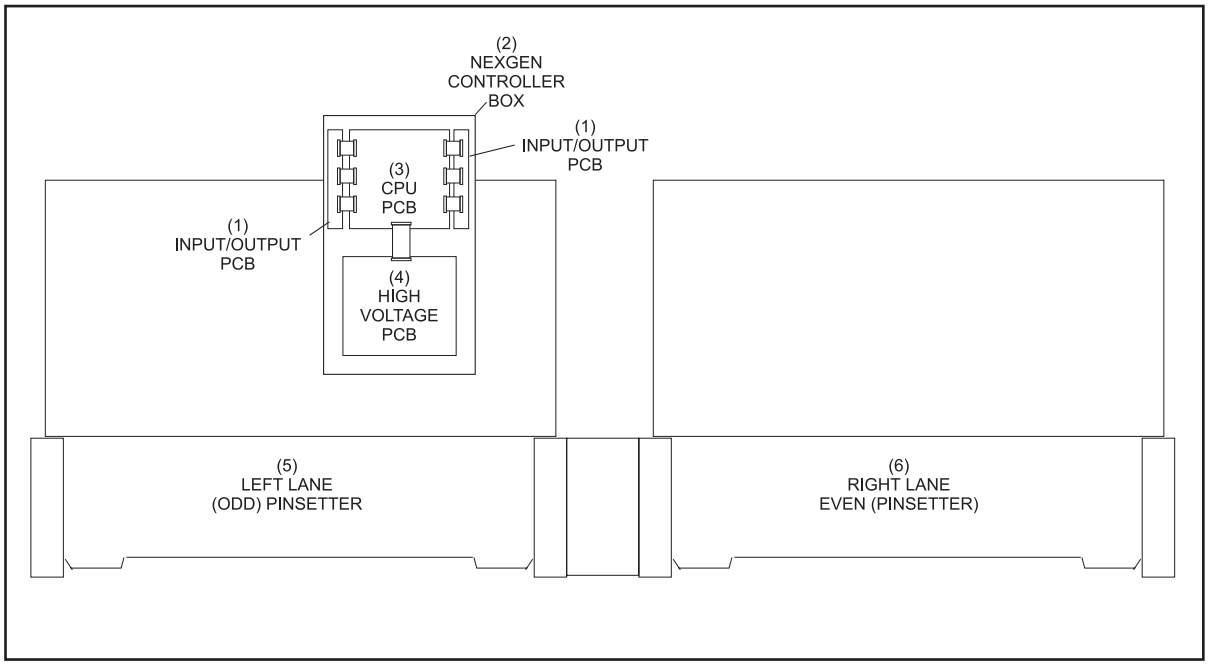


Figure 3-1. Nexgen Controller Box Layout.

(1) INPUT / OUTPUT PCB (2) NEXGEN CONTROLLER BOX (3) CPU PCB
(4) HIGH VOLTAGE PCB (5) LEFT LANE (ODD) PINSETTER (6) RIGHT LANE (EVEN) PINSETTER

The CPU Board gathers switch information and sends out solenoid voltage to each pinsetter through the I/O PCBs. Communication to the scoring system is also handled by the CPU.

The High Voltage board is the entry point for the 3-phase power needed to run the pinsetters. The High Voltage board supplies the power for the motors and pin lights for both pinsetters.

Figure 3-2 shows the flow of information and power paths between the pinsetters, several external devices and the electronic boxes.

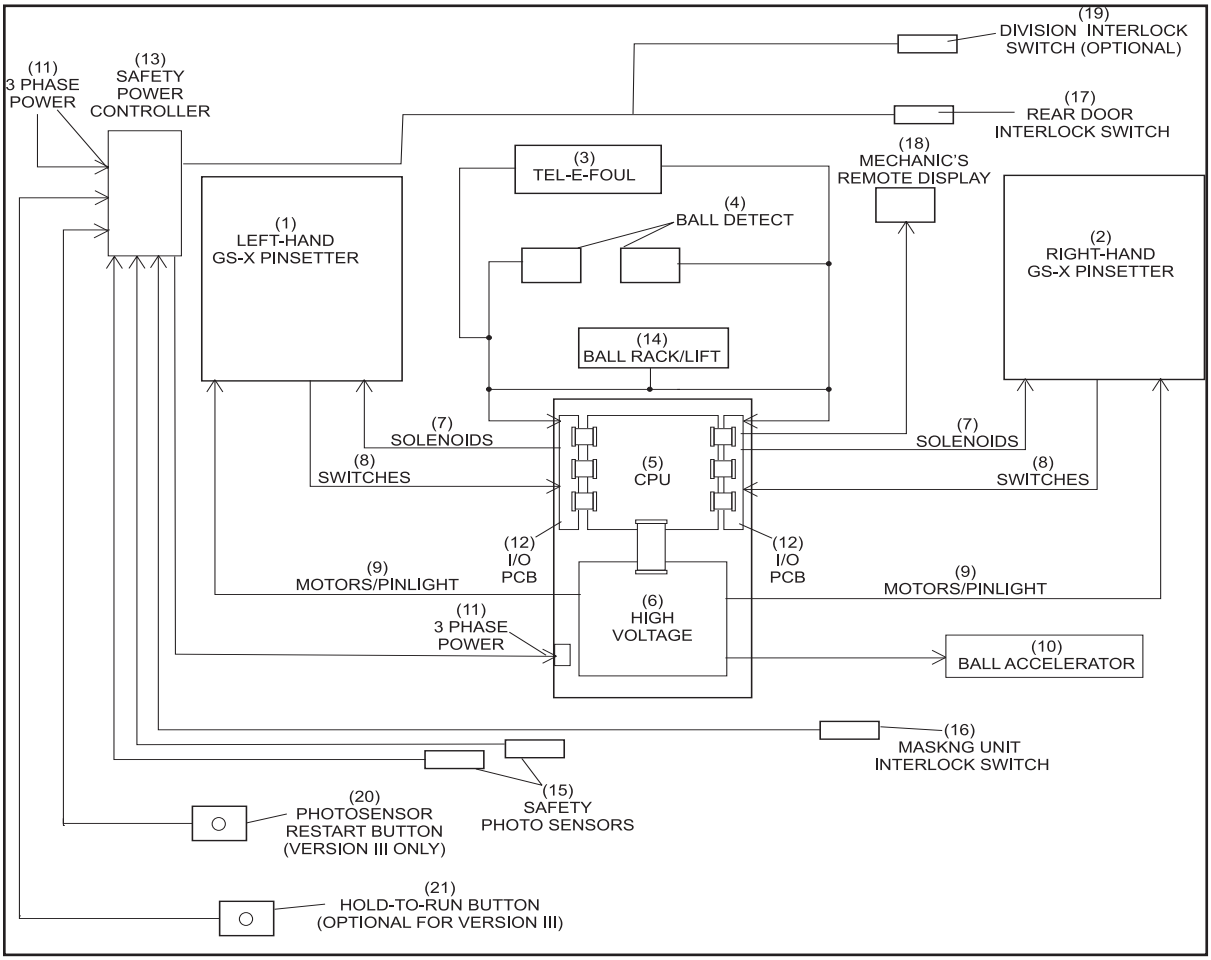


Figure 3-2. Pinsetter Block Diagram - Base and Fixed Guard Packages

(1) LEFT -HAND GS-X PINSETTER	(2) RIGHT -HAND GS-X PINSETTER	(3) TEL-E-FOUL
(4) BALL DETECT	(5) CENTRAL PROCESSING UNIT PCB	(6) HIGH VOLTAGE PCB
(7) SOLENOIDS	(8) SWITCHES	(9) MOTORS / PINLIGHT
(10) BALL ACCELERATOR	(11) 3 PHASE POWER	(12) INPUT/OUTPUT PCB
(13) SAFETY POWER CONTROLLER	(14) BALL RACK/LIFT	(15) SAFETY PHOTO SENSORS
(16) MASKING UNIT INTERLOCK SWITCH	(17) REAR DOOR INTERLOCK SWITCH	(18) MECHANIC'S REMOTE DISPLAY
19) DIVISION INTERLOCK SWITCH (OPTIONAL)	(20) PHOTOSENSOR RESTART BUTTON (VERSION III ONLY)	(21) HOLD-TO-RUN BUTTON (OPTIONAL VERSION III)

NEXGEN CONTROLLER BOX

The Nexgen Controller box used with advanced guards is similar to the one used for pinsetters equipped with base or fixed guard. The primary difference is that the emergency stop and safety interlock functions are housed in a Safety Controller box mounted on the elevator of the left pinsetter rather than incorporated into the Nexgen. . The Safety Controller receives incoming 3-phase power as well as the interlock signals and controls the 3-phase power to the Nexgen. Because of this the main power switch, emergency stop connectors and associated circuitry are removed from the Nexgen. The Nexgen box still controls power to all motors, the pin lights and the transformer used to power the CPU PCB. It also receives incoming switch information and controls the solenoids for both machines. The following is a description of the boxes' components and connections. Refer to Figures 3-3 and 3-4.

Left Side (Pinsetters with Advanced Guards)

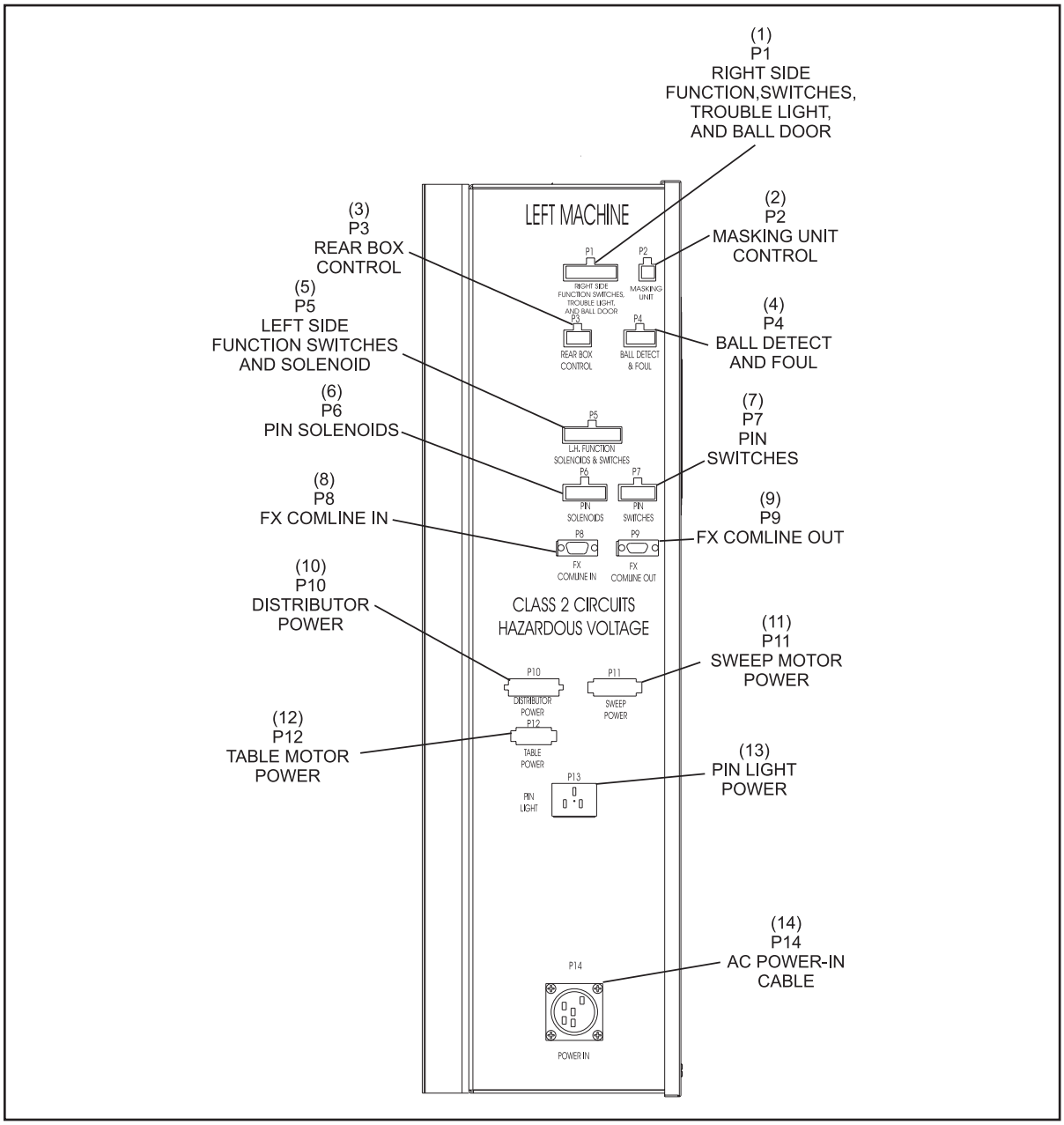


Figure 3-3. Nexgen Controller - Left Side View (Pinsetters with Base or Fixed Guards)

(1) **P1 (Right Side Function Switches, Trouble Light and Ball Door) -** Connection for the switches located on the right side of the odd lane (left) pinsetter. These switches include the "A," "B," "C," "D," "SM," "TS2," ,"AS" (ball accelerator overload) and "OOR." The connection also provides the voltage for the trouble light and the ball door solenoid for the left pinsetter.

(2) **P2 (Masking Unit Control) -** This connection provides power for 1st and 2nd ball lights on the masking unit.for the odd numbered (left) lane.

(3) **P3 (Rear Box Control) -** Input for stop/run switches located on the mechanic's remote display.

(4) **P4 (Ball Detect & Foul) -** This connection provides input from the ball detector, foul unit, and ball rack reset button for the odd (left) lane

(5) **P5 (Left Side Function Switches and Solenoids) -** This connection provides the input for the "TS1," "G," "EC" and pin count switches. It provides voltage to the sweep release, spotting tong, stroke limiter, and shark solenoids of the odd lane (left) pinsetter.

(6) **P6 (Pin Solenoids) -** The pin holder (gripper) solenoids for the left pinsetter are energized via the voltages sent from this connector

(7) **P7 (Pin Switches) -** This connection provides input from the pin holder switches and spotting tong (ST) switch for the left pinsetter.

(8) **P8 (FX Comline In) -** This connection is used to connect to Brunswick Scoring Systems. It provides two-way communication between the Pinsetter CPU and Brunswick Frameworx and Vector automatic scorers If software version 4.08.03 or higher is installed, this connection is also used to connect the pinsetter to AS-90 scorers.

(9) **P9 (FX Comline Out) -** This connection is used in Frameworx Scoring Systems. It routes communication signals through the Pinsetter CPU to the additional Frameworx lane devices such as TV-Only monitors.

(10) **P10 (Distributor Motor Power) -** Provides 3-phase power to the odd lane (left) pinsetter's distributor motor.

(11) **P11 (Sweep Motor Power) -** Provides 3-phase power to the odd lane (left) pinsetter's sweep motor.

(12) **P12 (Table Motor Power) -** Provides 3-phase power to the odd lane (left) pinsetter's table motor.

(13) **P13 (Pin Light Power) -** Provides 208 or 230 VAC single phase to the odd lane (left) pinsetter's pin light.

(14) **P14 (AC Power-In Cable) -** Input power connection for the 3-phase power coming from the Safety Power Controller.

Right Side (Pinsetters with Advanced Guards)

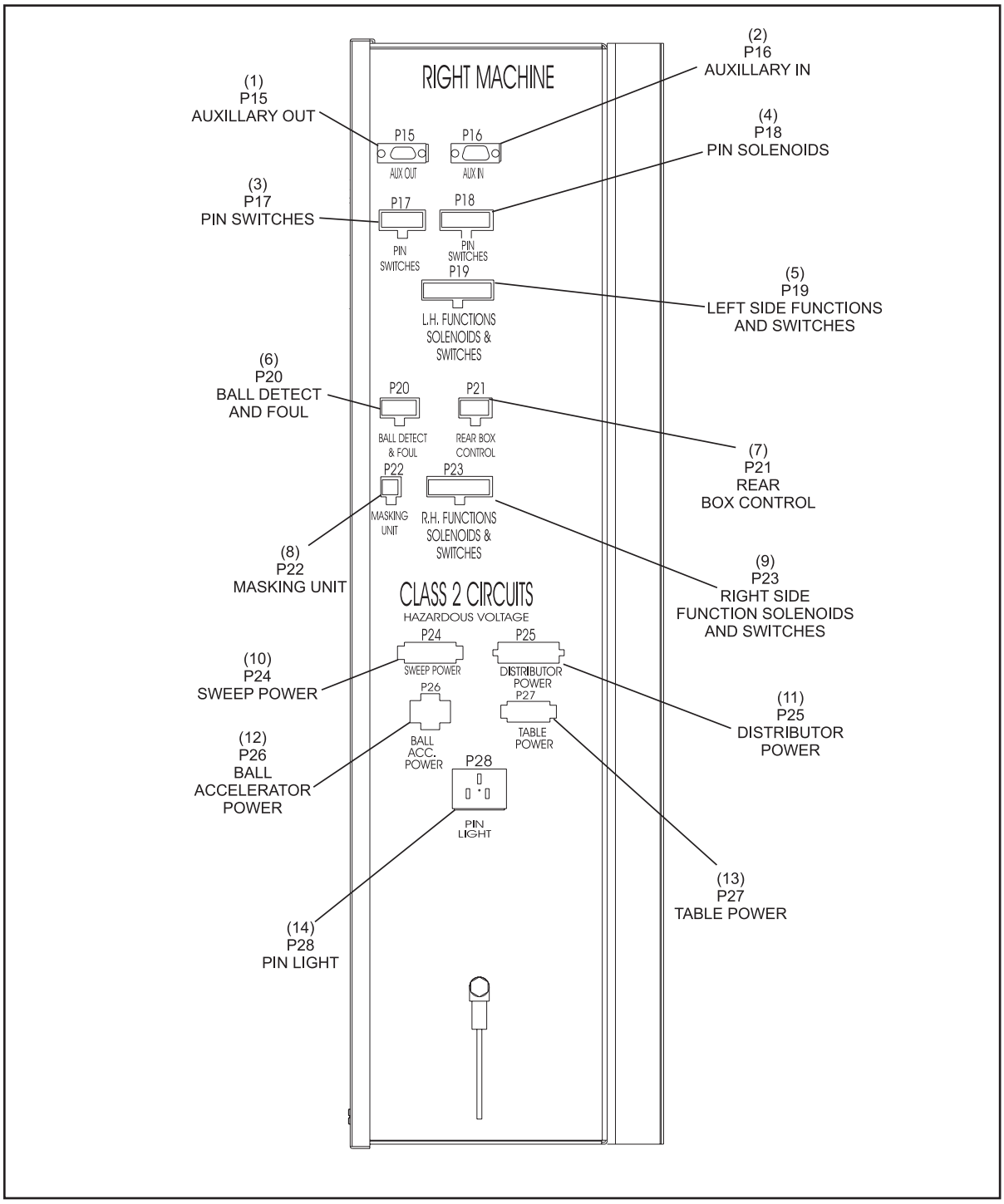


Figure 3-4 Nexgen Controller - Right Side View (Pinsetters with Base or Fixed Guards)

(1) P15 (Auxiliary Out) - Not Used

(2) P16 (Auxillary In) - Communication to a mechanic's rear display.

(3) P17 (Pin Switches) - This connection provides input from the pin holder switches and spotting tong (ST) switch for the right pinsetter.

(4) P18 (Pin Solenoids) - The pin holder (gripper) solenoids for the right pinsetter are energized via the voltage sent from this connector.

(5) P19 (Left Side Function Solenoids and Switches) - This connection provides the input for the "TS1," "G," "EC" and pin count switches and voltage to the sweep release, spotting tong, stroke limiter and shark solonoids for the even lane pinsetter. It also provides power for the optional mechanic's rear display.

(6) P20 (Ball Detect & Foul) - This connection provides input from the ball detector, foul unit, and ball rack reset button for the even lane

(7) P21 (Rear Box Control) - This connection provides input from the even lane pinsetter's stop/ run switch located on the mechanic's remote display.

(8) P22 (Masking Unit) - This connection provides power for 1st and 2nd ball lights on the masking unit.for the even (right hand) lane.

(9) P23 (Right Side Function Solenoids and Switches,) - Connection for the switches located on the right side of the even lane (right) pinsetter. These switches include the "A," "B," "C," "D," "SM," "TS2," and "OOR." The connection also provides the voltage for the status light, the ball door solenoid for the even lane pinsetter.

(10) P24 (Sweep Power) - Provides full 3-phase power to the even lane pinsetter's sweep motor.

(11) P25 (Distributor Power) - Provides 3-phase power to the even lane pinsetter's distributor motor.

(12) P26 (Ball Accelerator Power) - Provides 3-phase power to the ball accelerator motor.

(13) P27 (Table Power) - Provides 3-phase power to the even lane pinsetter's table motor.

(14) P28 (Pin Light) - Provides 208 or 230 VAC single phase to the even lane pinsetter's pin light.

Bottom (All Nexgen Controller Boxes)

Mounted on the bottom of the Nexgen box are two transformers. The transformers use an incoming 230 Volt or 208 Voltage from the High Voltage PCB and reduces it to 26VAC. This voltage is then sent to the CPU PCB (J11) where it is used to create the DC voltages for pinsetter operation.

How the transformers connect to the High Voltage PCB depends on the operating voltage of the pinsetter. Reference Figure 3-5 & Table 1 Transformer Taps. The BLK common wire will always connect to “J37” of the High Voltage PCB. Based on the Pinsetters voltage connect either the BLK/ RED or the BLK/YEL wire to “J25”. “J42 and “J43” are used as a “Holding” spot for unused wires.

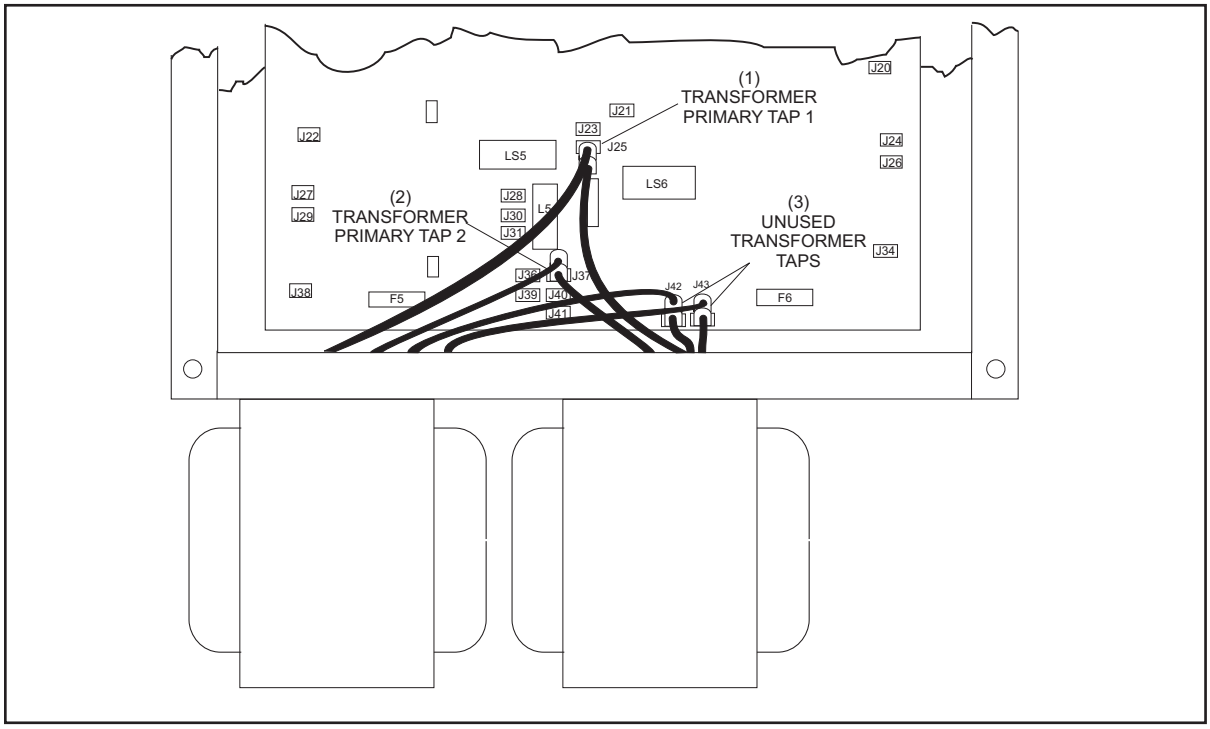


Figure 3-5. Nexgen Voltage Settings

(1) TRANSFORMER PRIMARY TAP 1 (2) TRANSFORMER PRIMARY TAP 2 (3) UNUSED TRANSFORMER TAPS

TRANSFORMER 1		
INPUT VOLTAGE	**WIRE**	**HIGH VOLTAGE PCB TERMINAL**
220V 380V 415V	BLK	J37
	BLK/RED	J25
	BLK/WHT	Not Used
	BLK/YEL	J42
208V	BLK	J37
	BLK/YEL	J25
	BLK/RED	J42
	BLK/WHT	Not Used
200V	BLK	J37
	BLK/WHT	J25
	BLK/YEL	J42
	BLK/RED	Not Used

Table 1.. Transformer Taps

TRANSFORMER 2		
INPUT VOLTAGE	**WIRE**	**HIGH VOLTAGE PCB TERMINAL**
220V 380V 415V	BLK	J37
	BLK/RED	J25
	BLK/WHT	Not Used
	BLK/YEL	J43
208V	BLK	J37
	BLK/YEL	J25
	BLK/RED	J43
	BLK/WHT	Not Used
200V	BLK	J37
	BLK/WHT	J25
	BLK/YEL	J43
	BLK/RED	Not Used

Table 2. Transformer Taps

INTERNAL

Internally, the Nexgen Controller box contains four circuit boards; a CPU PCB, a High Voltage PCB, and two I/O PCBs. A power filter is also provided to condition the incoming 3 phase power . Refer to *Figure 3-6*

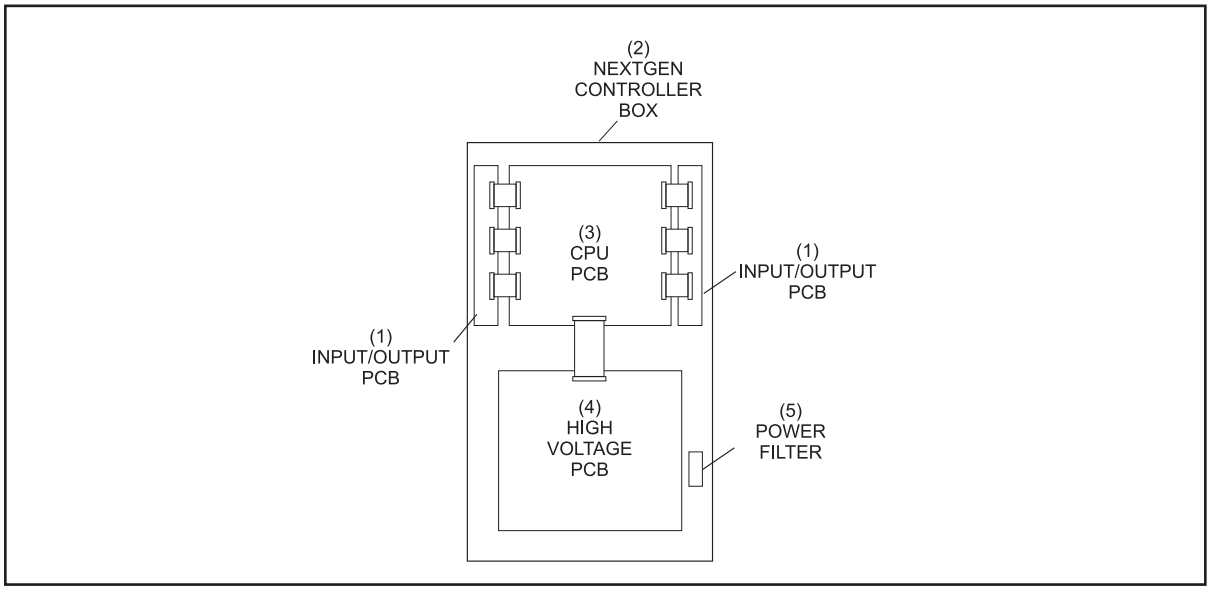


Figure 3-6. Nexgen Controller - Internal View

(1) INPUT / OUTPUT PCB (2) NEXGEN CONTROLLER BOX (3) CPU PCB
(4) HIGH VOLTAGE PCB (5) POWER FILTER

I/O PCBs

I/O is an acronym for input and output. These printed circuit boards receive the incoming information from the pinsetter and pass it to the CPU. The CPU then makes an appropriate decision and sends its commands back to the pinsetter through the I/O printed circuit board. Surge protection located on the PCB protects the CPU from damage. Refer to F*igure 3-7.*

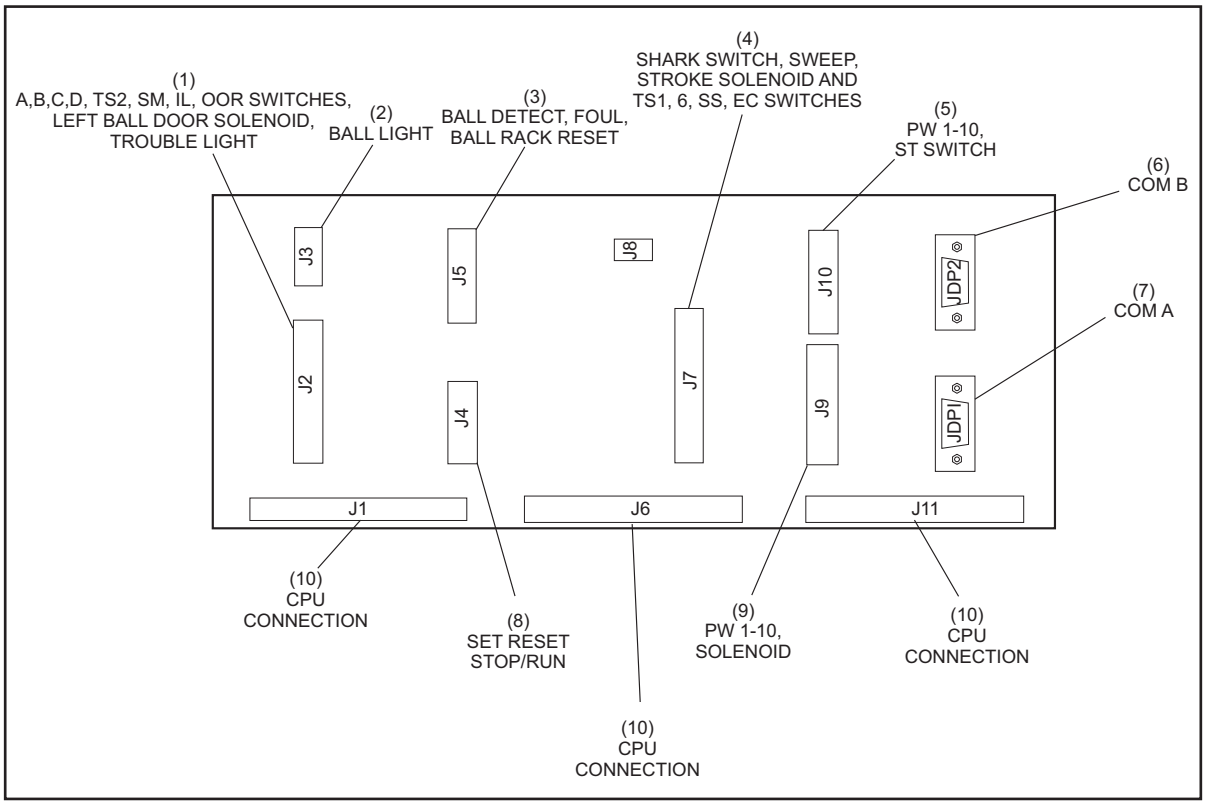


Figure 3-7. I\O PCB

(1) A,B,C,D, TS2, SM, IL, OOR SWITCHES, LEFT BALL DOOR SOLENOID, TROUBLE LIGHT	(2) BALL LIGHT	(3) BALL DETECT, FOUL, BALL RACK RESET
(4) SHARK SWITCH, SWEEP, STROKE SOLENOID, AND TS1, 6, SS, EC SWITCHES	(5) PW 1-10 ST SWITCHES	(6) COM B
(7) COM A	(8) SET RESET, STOP/RUN	(9) PW 1-10 SOLENOID
(10) CPU CONNECTION		

CPU PCB

CPU is an acronym for Central Processing Unit. This board accepts all the information from both I/O PCBs, and processes it to determine what each pinsetter must do. It then controls the pinsetter solenoids through the I/O PCBs and motors through the High Voltage PCB.

The CPU has a memory that retains the status and frame count of each pinsetter. Refer to *Figures 3-7 & 3-8.*

The function of the components and connectors on the CPU PCB are as follows

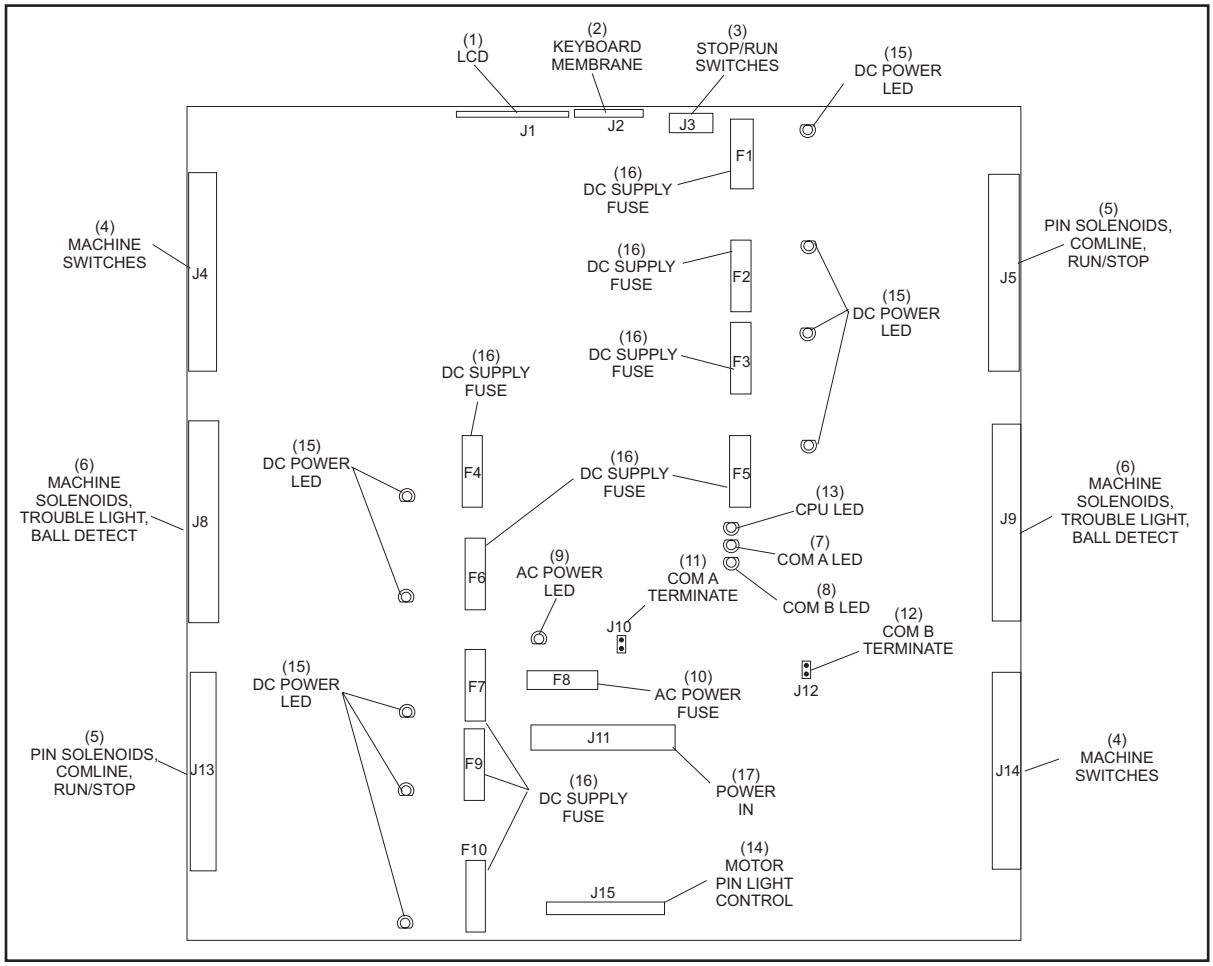


Figure 3-8. CPU PCB.

NOTE: *All fuses are rated at 250V 3.15A - fast blow.*

(1) LCD (J1) - Not Used

(2) Keyboard Membrane (J2) - Not Used

(3) Stop/Run Switches (J3) - Not used - Install jumpered connector..

(4) Machine Switches (J4, J14) - Input connection for the following machine signals: TS1 ,G, pin count, EC, A, B, C, D, TS2, SM, IL, ST and OOR switches, all 10 pin holders switches, rear control box set and reset switches, ball rack reset switch, foul unit, and ball detector. J4 connects to the left pinsetter while J14 is for the right pinsetter.

(5) **Pin Solenoid,Comline,Stop/Run (J5, J13) -** This connection supplies voltage to the pinholder solenoids and ball lift and is the connection for the Stop/Run Switch located on the elevator. The communication to the Frameworx scorer system is also handled by this connection. J5 connects to the right pinsetter and J13 connects to the left pinsetter.

(6) **Machine Solenoids,Trouble Light,Ball Detect (J8 ,J9) -** Connection that supplies voltage to the spotting tong, sweep release, shark, and ball door solenoids and the trouble lights. This connection also provides input for the ball detectors. J8 is for the left pinsetter and J9 is for the right pinsetter.

(7) **Com A LED -** Labeled "Com A" this LED lights when communication to the Frameworx scorers is functioning properly.

(8) **Com B LED -** Labeled Com "B" - not used.

(9) **AC Power LED -** This LED lights when the AC input voltage to the CPU is present. Refer to Table 2 LED and Fuse Information.

(10) **AC Power Fuse (F8) -** Fuse used to protect the CPU from excessive AC input power. This fuse are rated at 250V 3.15A - fast blow. Refer to Table 2 LED and Fuse Information.

(11) **Com A Termination (J10) -** Com A termination jumper.

(12) **Com B Termination (J12) -** Com B termination jumper.

(13) **CPU LED -** Labeled "CPU" this LED lights when the microprocessor is operating properly.

(14) **Motor, Pin Light Control (J15) -** Connection to the High Voltage PCB used to control the motor and pin light operation for both pinsetters .

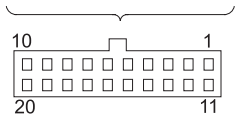
(15) **DC Power LEDs -** These LEDs light when the DC voltage for the 26 Volt circuitry is operating. Refer to Table 2 LED and Fuse Information.

(16) **DC Power Fuses (F1-F7, F9, F10) -** Fuses used to protect the 26VDC circuitry. These fuses are rated at 250V 3.15A - fast blow.

(17) **Power In (J11) -** Input for 26VAC power coming in from the main transformer.

LED INDICATOR	FUSE NUMBER	DESCRIPTION	TRANSFORMER TERMINALS
PCB POWER			
AC-A	---	AC POWER INDICATION	1, 11
DC-A	F8	MAIN DC POWER FOR CPU	
LEFT PINSETTER			
DC-B	F10	1, 2, 3 PINHOLDER SOLENOIDS SPOTTING TONG SOLENOID	2, 12
DC-C	F9	4, 5, 6 PINHOLDER SOLENOIDS, STROKE LIMITER SOLENOID FRAME COUNTER	3, 13
DC-D	F7	7, 8, 9 PINHOLDER SOLENOIDS STROKE LIMITER SOLENOID FRAME COUNTER	4, 14
DC-E	F6	SHARK SOLENOID BALL DOOR SOLENOID 10 PINHOLDER SOLENOID	5, 15
RIGHT PINSETTER			
DC-F	F1	1, 2, 3 PINHOLDER SOLENOIDS SPOTTING TONG SOLENOID	6, 16
DC-G	F2	4, 5, 6 PINHOLDER SOLENOIDS SWEEP RELEASE SOLENOID	7, 17
DC-H	F3	7, 8, 9 PINHOLDER SOLENOIDS STROKE LIMITER SOLENOID FRAME COUNTER	8,18
DC-I	F5	SHARK SOLENOID BALL DOOR SOLENOID 10 PINHOLDER SOLENOID	9,19
COMMON			
DC-J	F4	L/R BALL DETECTORS L/R TROUBLE LIGHTS BALL LIFT MOTOR CONTROL MASKING UNIT LIGHTS	10, 20

Table 2. LED and Pulse Information



High Voltage PCB

The High Voltage board is the entry point for the 3-phase power needed to run the pinsetters. The High Voltage board uses this power to control the motors and pin lights for both pinsetters. Fuses on the PCB are used to protect the motors and pin lights. Refer to *Figures 3-9,* and *3-16.*

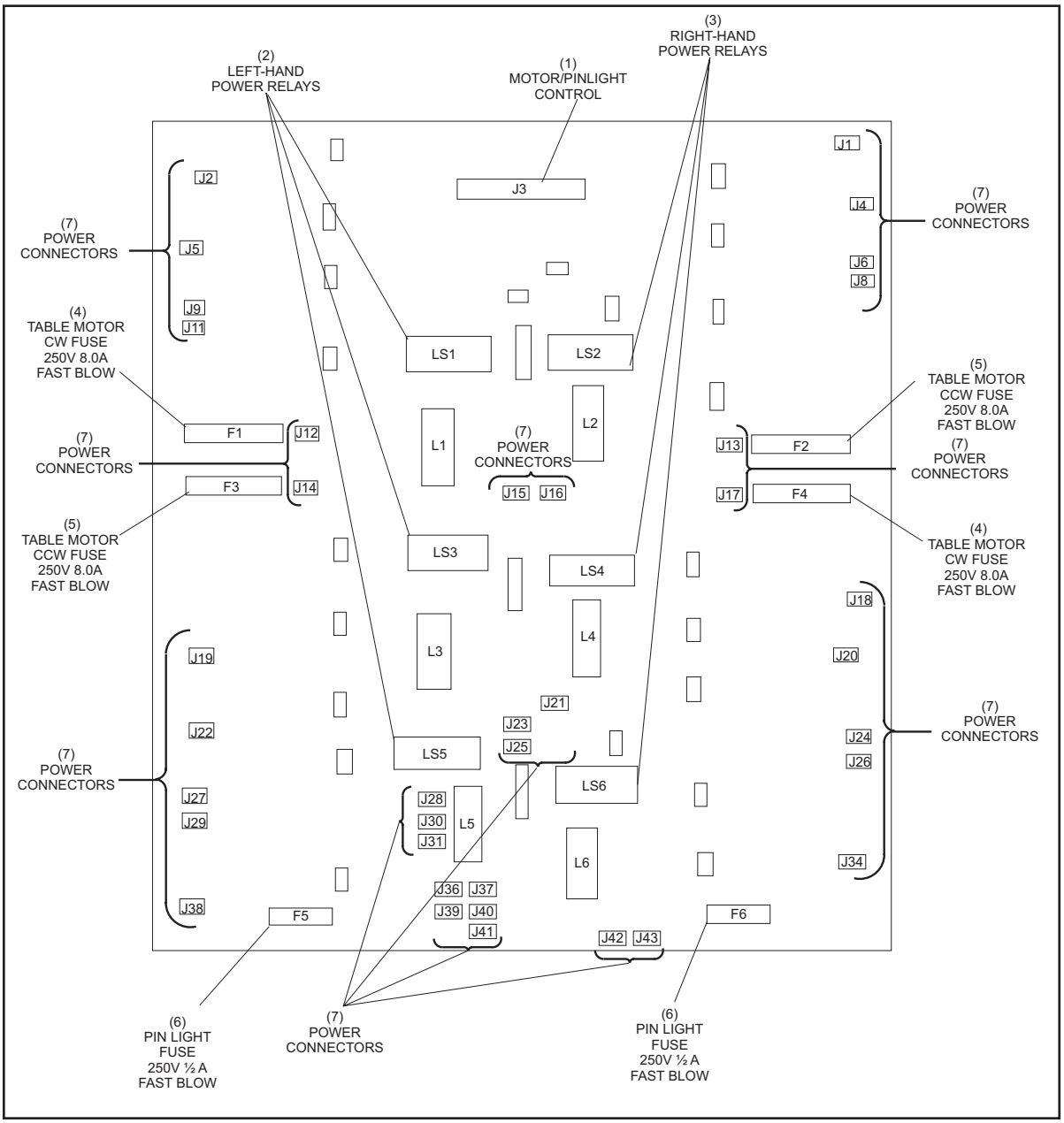


Figure 3-9. Nexgen Controller - High Voltage PCB

The function of the component on the High Voltage PCB are:

(1) Motor/Pinlight Control (J3) - Connection for the cable originating at the CPU PCB. The High Voltage is "told" when to turn the motors and pinlights ON/Off through this connection.

(2) Left Hand Power Relays - Main power relays for each phase of power entering the Nexgen box. When energized power is made available to the left pinsetter's motor and pin light circuitry.

(3) Right Hand Power Relays - Main power relays for each phase of power entering the Nexgen box. When energized power is made available to the right pinsetter's motor and pin light circuitry.

4) Table Motor CW Fuse(F1,F4) - Fuses used to protect the table motor circuitry from excessive current when turning the table motor on in a clockwise rotation. F1 is for the left pinsetter, F4 is for the right pinsetter. The fuses are rated at 250V 8.0A - fast blow.

(5) Table Motor CCW Fuse(F2,F3) - Fuse used to protect the table motor circuitry from excessive current when turning the table motor on in a counterclockwise rotation. F3 is for the left pinsetter, F2 is for the right pinsetter. The fuses are rated at 250V 8.0A - fast blow.

(6) Pin Light Fuses (F5,F6) - Fuses used to protect the pin lights from excessive current. F5 is for the left pinsetter, F6 is for the right pinsetter.
The fuses are rated at 250V 1/2 A - slow blow.

(7) Power Connectors - Connections to pinsetter motors and pinlight. Refer to figure 3-16 for the wiring diagram of the high voltage PCB.

LCD Display/User Interface

Setup and diagnostics for the both pinsetters is performed using the mechanic's remote display. Refers to *Figure 3-10.*

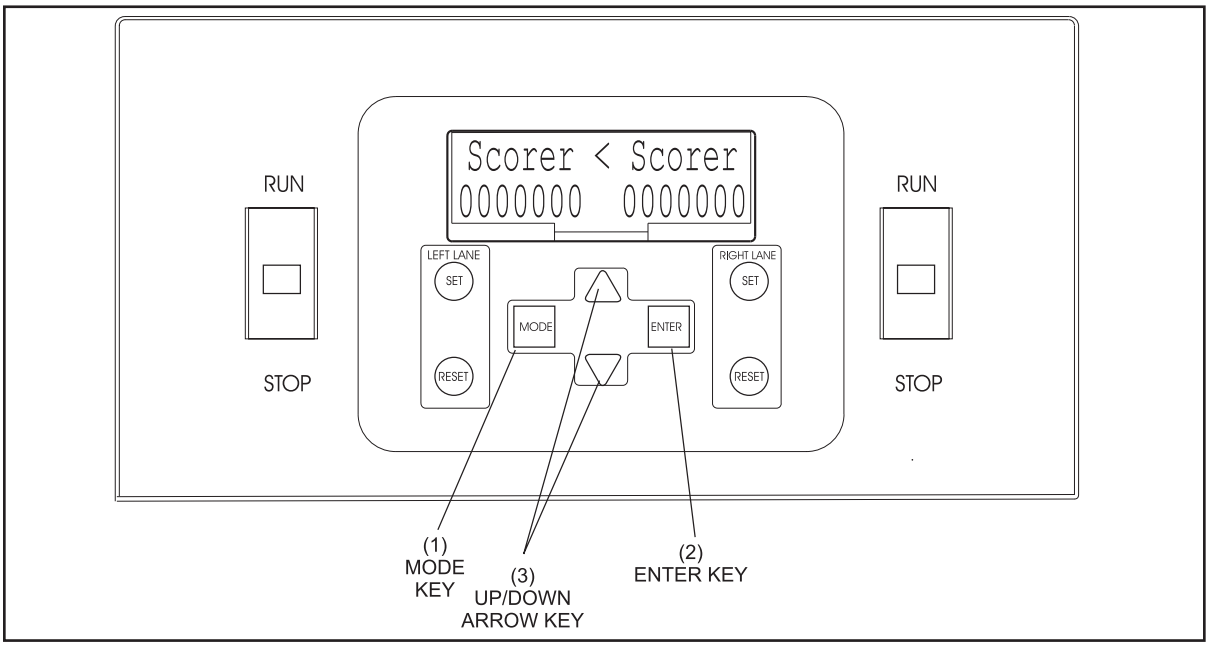


Figure 3-10. Nexgen Remote Display - LCD Panel

Four keys on the control panel are used to navigate the user menu.

(1) Mode Key - Use this button to step through the pinsetter modes when the mode selection menu is being displayed or to return to the mode selection menu.

(2) Enter Key - The function of this key is dependent on what is being displayed on the LCD. If the mode displayed on the LCD does not have a submenu, this key allow the user to select the left or right lane. When the mode displayed on the LCD has a submenu, the Enter key steps through the submenu selections.

(3) Up/Down Arrows - The function of this key is dependent on what is displayed on the LCD. When the mode selection menu is displayed, this key allows the user to step through the pinsetters modes. When in a submenu, the arrow keys allow the user to toggle the choices of the feature selected in the submenu.

During power up of the Nexgen Controller, the unit it goes through a boot up sequence. The Controller's LCD display will first display "Brunswick GS-X" and then display "Software V 4.xx.xx EPROM OK". (xx.xx represents the software version such as 4.95.26). Once the controller successfully boots up, the mode selection menu is displayed.

The Mode selection menu has the following choices:

Scorer - Use this mode when the GS-X is connected to Frameworx or Vector scoring systems. This selection does not have a submenu. For firmware versions prior to 4.94 this mode is labeled Frmwrx.

Tenpin - Use this setting when the GS-X is NOT connected to a scoring system or is operating in a stand-alone mode. This selection does not have a submenu.

AS-90 - This setting appears only if software version 4.08.03 or higher is installed in the Nexgen box. Use this setting when a GS-X is connected to an AS-80, or AS-90 scorer. This selection does not have a submenu.

Diag - This selection allows the mechanic to put the selected pinsetter into cycle diagnostics mode. This selection does not have a submenu.

Motor - This selection allows the mechanic to manually run the pinsetter motors on the selected machine by pressing and holding the "Up" arrow key. A submenu that appears when the stop/run switch is set to the run position has the following choices:

Table CW - This selection runs the table motor of the selected lane in a clockwise rotation.

Table CCW - This selection runs the table motor of the selected lane in a counterclockwise rotation.

Distrib - This selection turns the distributor motor of the selected lane "On".

Sweep - This selection turns the sweep motor of the selected lane "On".

Pinlight - This selection caused the pinlight of the selected pinsetter to turn on.

Clean - This menu selection causes the sweep to drop when the Stop/Run switch is turned "On". It also allows the mechanic to run the distributor motor by pressing and holding the up arrow key.

NOTE: *The following selections are available only when the STOP/RUN switches for both pinsetters are in the STOP position.*

Setup - This selection allows the user to configure the pinsetter's operating characteristic. A submenu for this selection has the following choices:

NOTE: *Use the enter button to select the desired choice then arrow buttons to choose yes or no.*

Firmware Version: The firmware version is displayed in the setup menu for firmware versions 4.95.21 and later.

Left Lane ## - Sets the lane ID for the lane pair. Currently, this selection is not used.

Double Detect: (Y or N) - Gives the pinsetter the choice of detecting pin activity on second ball. If a scoring system is present that has the capability of interfacing with the CPU, it can use the pin holder switch information to determine the bowler's pinfall. If no scoring system is available, or the scoring system uses a scanner or camera for determining pinfall, turning this switch on disables the detection stroke of the setting table during the second ball.

Y - Double Detect - Set if a scanner or CCD Camera are not used. (Frameworx scoring system) (default)
N - Single Detect - Set if a scanner, CCD Camera or VPS are used or if no scoring system is used.

Enable OOR: (Y or N) - Enable or disables the out-of-range cycle. Most bowling organizations require that the pinsetter stop and any deadwood (pins that have been knocked over but are still in the field of play) must be removed before the next ball can be rolled. If your center has sanctioned leagues that require deadwood be removed before choose "Y" otherwise choose "No".

Y - Pinsetter stops for an out-of-range pin. (default)
N - Ignores an out-of-range pin.

Table Delay: (Y or N) - This selection controls the delay of the setting table operation after the sweep drops to a guarded position.

Y - Delayed setting table - USBC, FIQ..., compliant delay. (Default)
N - Quick setting table - No delay after sweep drop.

Distrib Stop: (Y or N) - This selection determines if the distributor will stop after all 10 pins have been delivered to the pin holders while waiting for a 2nd ball cycle. The suggested setting for this option is "N".

Y - Stop enable - Distributor stops after ten pins have loaded while waiting for a 2nd ball.
N - Stop disabled - Continuous distributor operation while loading pin. (default)

Enable 50 ERR (Y or N) - This selection allows pinfall detection to be monitored or ignored during machine cycle diagnostics.

Y - Enable Codes (default)
N - Disable Codes

Enable Foul: (Y or N) - This selection allows you to accept or ignore the foul signal coming from the foul unit.

Y - The pinsetter will accept the foul signal (default)
N - Foul Signals are ignored.

Dist Slow Start: (Y or N) - The selection determines whether the distributor will start slowly and gradually increase speed or start at full speed. The suggested setting for this option is ”N”. This selection is available on machines beginning with software version 4.08.02. It was been removed for software versions 4.95.21 and later.

Y - Slow start enabled
N - Slow start is disabled (default)

Long Err Codes: (Y or N) - This selection is available on machines with software version 4.08.02 and higher. The selection determines whether the display will show error code using the standard 2 digit code or extended code.

Y - Display error codes using extended format
N - Display error codes using 2 digit format

Pinlight: (Y or N) - This selection is available on machines with version 4.08.02 and higher. This selection turns on the pinlight so that the pins are illuminated even when the machine is unassigned.

Y - Pinlight on
N - Pinlight off (default)

Enable PF Err: (Y or N) - This selection is available on machines with software version 4.95.21 and higher. This selection allows the mechanic to enable (or disable) an error code that would occur in the event that the pinsetter loses power.

Y - Enable the code (default)
N - Disable the code

Off Sweep Dwn: (Y or N) - This selection is available on machines with software version 4.95.21 and higher.This selection causes the sweep to drop when the lane is turned off from the scorer. The sweep will not drop when the pinsetter is turned off via a local mechanic’s switch.

Y - Enable sweep drop
N - Disable sweep drop (default)

Trouble Blink: (Y or N) - This selection is available on machines with software version 4.95.21 and higher. This selection determines whether the light on the elevator will perform as a traditional trouble light and be "off" during machine operation or as a status light and remain "On" during machine operation.

Y - Normally "Off", "flashing" for errors.
N - "Off" when machine is turned off, "On" when the machine is operating, flashing for errors. (default)

Distrib Time: (45, 50, 55, 60) - Distributor time out. This selection determines how long the distributor runs at the end of a pinsetter cycle if an addition ball detection does not occur. The selection is available on machines with software version 4.95.21 and higher.

45 - 45 seconds (default)
50 - 50 seconds
55 - 55 seconds
60 - 60 seconds

Shdw Bwl Time: (0, 1, 2, 3): This selection is available on machines with software version 4.95.21 and higher. It determines the amount of time the ball accelerator will continue running after the pinsetter has been turned off in order to allow the ball to return to the bowler. The pin light is off during this time and the pinsetter will not cycle.

00 - Disabled (default)
01 - 1 minute
02 - 2 minutes
03 - 3 minutes

NOTE: For centers that have either Vector Desk version 3.3.0.863 (or higher) or Vector Plus version 2.8.23 (or higher), this feature can also be implemented through the scorer. It is recommended that the 0 be used as the NexGen setting when the scorer is controlling this feature.

Coast Past A : (00,06,07,08,09,10) - This selection is available on machines with software version 4.95.21 and higher. This selection allows the table to continue past the 'A" switch after a 1st ball non strike cycles so the pinstation retaining bows can clear pins that may be loaded in the pin holders. This causes the ejector flaps to return to their up position allowing the stations to resume collecting pins, thus reducing overflow.

00 - Disabled (available with firmware version 4.95.26 and later)
06 - 10 - Select the lowest number possible that allows the table to drop just far enough to cause all the ejector flaps to return to their up position. Default = 08

NOTE 1: Always select the lowest number possible that allows the table to drop just far enough to cause the all the ejectors to return to their up position. Be aware that when the table continues past "A" the sweep will also lower. As a result you may begin to see a little bit of the sweep board below the masking unit on 2nd ball. A minor adjustment to the sweep board height will typically correct this.

NOTE 2: When the table continues past "A" the sweep will also lower. This may result in insufficient clearance for some lane machines to pass under the sweep. Always verify there is sufficient clearance for your lane machine after changing this setting. (A minor adjustment to the sweep board height will typically correct this.) It is suggested that the pinsetter be on 1st ball prior to running your lane machine so that the sweep will always be at its highest position.

SW Diag - This selection allows the user to check the switches and switch wiring on the pinsetters. The display will list the switches that are actuated (closed) are used during the time the check is being made. A submenu for this selection has the following choices:

Pin SW (Left) - This selection checks the pinholder switches and displays the ones that are actuated on the left pinsetter.

Table SW (Left) - This selection checks the Table switches A, B, C , D, TS1, and TS2 and displays the ones that are actuated on the left pinsetter.

Mach SW (Left) - This selection checks the machine switches EC,(E),G, SM, OOR, ST, Pincount Switch (SS), and displays the ones that are actuated on the left pinsetter.

EXT SW (Left) - This selection checks the external inputs Ball Detect, Foul, Set And Reset and displays the ones that are actuated on the left pinsetter.

Pin SW (Right) - This selection checks the pinholder switches and displays the ones that are actuated on the left pinsetter.

Table SW (Right) - This selection checks the Table switches A, B, C , D, TS1, and TS2 and displays the ones that are actuated on the right pinsetter.

Mach SW (Right) - This selection checks the machine switches EC (E),G, SM, OOR, ST, Pincount Switch (SS), and displays the ones that are actuated on thehe right pinsetter.

EXT SW (Right) - This selection checks the external inputs Ball Detect, Foul, Set And Reset and displays the ones that are actuated on the right pinsetter.

DIAGNOSTIC MODES

Trouble Diagnostics

The GS-X pinsetter monitors its function switches for proper operation and will shut down a pinsetter if a fault is detected. When a problem occurs, the pinsetter will shut down and the status light on the top of the elevator will start to flash. The error code displayed on the LCD Display of the mechanic's remote display can be used to diagnose the problem.

Contact Closure Diagnostics (Switch Diagnostics)

In addition to trouble diagnostics, the GS-X is capable of performing two diagnostic modes for testing pinsetter operations; one mode, contact closure diagnostics, checks the switches on the pinsetter and displays which switches are closed during the time the check is being made. This mode can be used to verify that switches are working properly and the wiring between the Nexgen Controller box and the individual switches is correct.

Machine Cycle Diagnostics

The machine cycle diagnostics, puts the pinsetter into a continuous operating cycle in which the pinsetter operates as if it was in a ten pin bowling mode, with the following exceptions. Instead of waiting for a ball detect, a five second time signal from the CPU starts the pinsetter cycle. The pinsetter will continue to set, reset, sweep and reload pins as long as it is switched into the diagnostic mode. Fouls will be ignored during the diagnostics. Diagnostic faults (failures) are active during diagnostics and can stop the pinsetter if a jam or some form of failure is detected.

Contact Closure Diagnostics (Switch Diagnostics)

1. The contact closure diagnostics can only be performed when both pinsetters are off (stop/run switches in the stop positions) The pinsetter is selected by having the following conditions available.

    a. The pinsetter cannot be in an error condition.

    b. For pinsetters equipped with base or fixed guards, the Stop/Run switch on the rear mechanic box must be set to Run.

    c. Both the left and the right stop/run switches on the Nexgen Controller box or the Mechanics Remote Display must be switched to the "stop" position. Refer to *Figure 3-6*

    d. To activate Contact Closure diagnostics, press the [Mode] key on the control panel until the mode "SW Diag" appears on the display.

    e. Press the [Enter] key to step through the display options.

        Pin SW (Left) - Displays the pinholder switches that are actuated on the left pinsetter. A "-" indicates the switch is open.

        Table SW (Left) - Display switches A, B, C, D, TS1, and TS2 of the left pinsetter if actuated. A "-" indicates the switch is open.

        Mach SW (Left) - Displays switches E(EC), G, SM, OOR, ST, and SS (Pincount Switch) of the left pinsetter if actuated. A "-" indicates the switch is open.

        EXT SW (Left) - Displays the Ball Detect, Foul, Set And Reset Switches if actuated for the left pinsetter. A "-" indicates the switch is open.

        Pin SW (Right) - Displays the pinholder switches that are actuated on the right pinsetter. A "-" indicates the switch is open.

        Table SW (Right) - Display switches A, B, C, D, TS1, and TS2 of the right pinsetter if actuated. A "-" indicates the switch is open.

        Mach SW (Right) - Displays switches E(EC), G, SM, OOR, ST, and SS (Pincount Switch) of the right pinsetter if actuated. A "-" indicates the switch is open.

        EXT SW (Right) - Displays the Ball Detect, Foul, Set And Reset Switches if actuated for the right pinsetter. A "-" indicates the switch is open.

Machine Cycle Diagnostics

1. To enter into this mode, the following conditions are necessary.

    a. The pinsetter cannot be in an error condition.

    b. The stop/run switch for the pinsetter is being tested must be switched to the "stop" position. Refer to *Figure 3-18*.

    c. All other interlock switches or other stop/run switches must be on.

2. To activate cycle diagnostics, press the [Mode] key on the control panel until the mode "Diag" appears on the display.

3. Turn the stop/run switch for the pinsetter is being tested to the "run" position.

4. If a pinsetter stops during diagnostics and the status light is flashing, check the error code displayed on the mechanic's remote display. Refer to *Table 4*.

NOTE: *In order to see error codes 50-59 (Detect 1 - Detect 9, Detect 10) in Machine Diagnostics, the Enable 50 ERR must be set to Y.*

Tables 3 and *4* list possible error codes and describe the most likely cause for the error. The displayed code may not pinpoint the problem in all cases. For further explanation of the codes, refer to the "*Troubleshooting"* section of this manual.

Error Code	Switch Settings				Problem
	Table	Sweep		Spotting Tongs	
	"A"	"G"	"SM"	"ST"	
90 (Invld 0)	Actuated	Unactuated	Unactuated	Actuated	Sweep is up but it is not forward
91 (Invld 1)	Unactuated	Unactuated	Unactuated	Actuated	Sweep is up but it is not forward and the Table is not at home position
92 (Invld 2)	Unactuated	Actuated	Unactuated	Actuated	Sweep not forward, table is not at home position
93 (Invld 3)	Actuated	Unactuated	Unactuated	Unactuated	Sweep is up but not forward and the spotting Tongs are closed
94 (Invld 4)	Unactuated	Unactuated	Unactuated	Unactuated	Sweep is up but it is not forward and the Table is not at home position and the Spotting Tongs are closed
95 (Invld)	Unactuated	Actuated	Unactuated	Unactuated	Sweep is not forward, the Table is not at home position, and the Spotting Tongs are closed.

Table 3. Invalid Machine State Error Codes

Std. Code	Extended Code	
P0	Pin OOR	Out-Of-Range
01	Pin1Ld	Pin Loading Time Out Pin 1
02	Pin2Ld	Pin Loading Time Out Pin 2
03	Pin3Ld	Pin Loading Time Out Pin 3
04	Pin4Ld	Pin Loading Time Out Pin 4
05	Pin5Ld	Pin Loading Time Out Pin 5
06	Pin6Ld	Pin Loading Time Out Pin 6
07	Pin7Ld	Pin Loading Time Out Pin 7
08	Pin8Ld	Pin Loading Time Out Pin 8
09	Pin9Ld	Pin Loading Time Out Pin 9
10	Pin10Ld	Pin Loading Time Out Pin 10
50	Detect10	#10 Pin Not Detected in Diagnostics
51	Detect1	#1 Pin Not Detected in Diagnostics
52	Detect2	#2 Pin Not Detected in Diagnostics
53	Detect3	#3 Pin Not Detected in Diagnostics
54	Detect4	#4 Pin Not Detected in Diagnostics
55	Detect5	#5 Pin Not Detected in Diagnostics
56	Detect6	#6 Pin Not Detected in Diagnostics
57	Detect7	#7 Pin Not Detected in Diagnostics
58	Detect8	#8 Pin Not Detected in Diagnostics
59	Detect9	#9 Pin Not Detected in Diagnostics
60	AFound	Switch A is Not Expected But Found
61	BFound	Switch B is Not Expected But Found
62	CFound	Switch C is Not Expected But Found

Std. Code	Extended Code	
63	D Found	Switch D is Not Expected But Found
64	SM Found	Switch SM is Not Expected But Found
65	G Found	Switch G is Not Expected But Found
66	ST Found	Switch ST is Not Expected But Found
67	OOR Found	Switch OOR is Not Expected But Found
70	A Ntfnd	Switch A Expected But Not Found
71	B Ntfnd	Switch B Expected But Not Found
72	C Ntfnd	Switch C Expected But Not Found
73	D Ntfnd	Switch D Expected But Not Found
74	SM Ntfnd	Switch SM Expected But Not Found
75	G Ntfnd	Switch G Expected But Not Found
76	ST Ntfnd	Switch ST Expected But Not Found
90	Invld 0	Invalid Machine State 0
91	Invld 1	Invalid Machine State 1
92	Invld 2	Invalid Machine State 2
93	Invld 3	Invalid Machine State 3
94	Invld 4	Invalid Machine State 4
95	Invld 05	Invalid Machine State 5
EJ	ElevJam	Elevator Jam
EL	Pin Crt	Pin Count Switch Shorted for 5 Seconds
J1	TS1 Jam	Jam Switch TS1
J2	TS2 Jam	Jam Switch TS2 (Tower)
	BA	Accelerator Motor (Overload)
	IL	Interlock Switch Open
	PF	Power Failure Has Occurred

Table 4. Error List

RELATED ELECTRONICS

Ball Detect - Photocell Triggering

The photocell is an optical device used to detect a ball entering the pinsetter. It consists of a transmitter/receiver device and a retroreflector. The transmitter/receiver device is mounted on the ball return kickback and the retroreflector is mounted on the division kickback. They are positioned directly across from each other at 25 mm (1") above the capping. Refer to Figures 3-11 and 3-12.

The transmitter sends an infrared beam across the lane to the retroreflector which reflects the beam back to the receiver. When any object cuts this beam, the receiver sends a pulse to the Pinsetter CPU. The Pinsetter CPU then cycles the corresponding pinsetter.

WARNING: A strong light source such as a camera's electronic flash may cause the pinsetter to trigger.

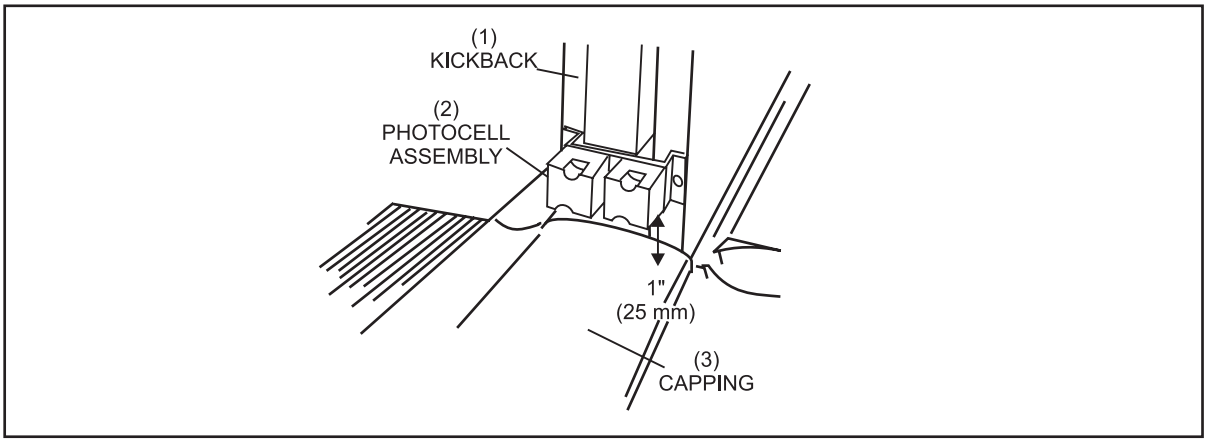


Figure 3-11. Ball Detect.

(1) KICKBACK (2) PHOTOCELL ASSEMBLY (3) CAPPING

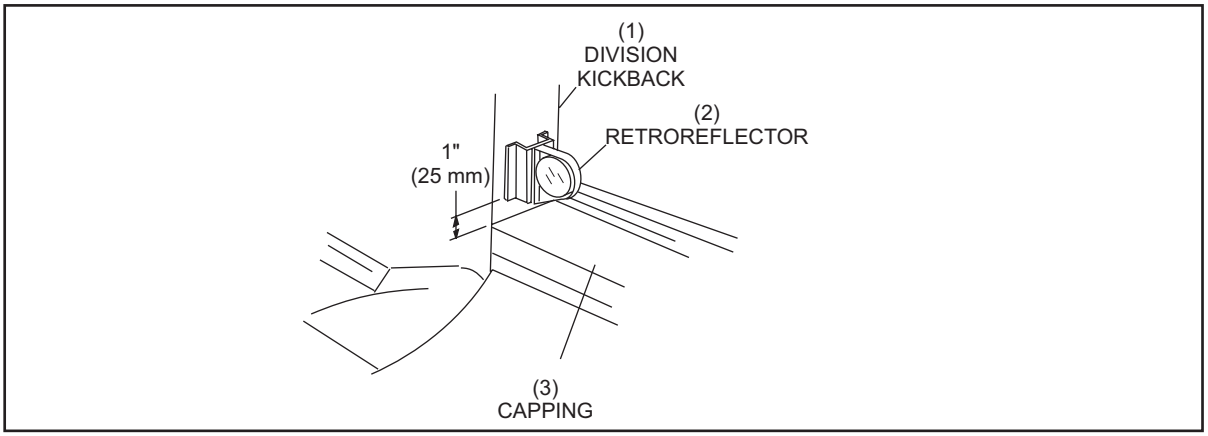


Figure 3-12. Retroreflector.

(1) DIVISION KICKBACK (2) RETROREFLECTOR (3) CAPPING

Foul Detect

The foul detect is located at the foul line and is mounted between the pair of lanes on the ball return capping. Reflectors mounted on division return the beam to the foul detect. If a foot or some other object interrupts this beam a signal is sent to the Pinsetter CPU to make the pinsetter set ten new pins if the machine is in a first ball foul situation while bowling a ten pin game format. The foul detect will not register a foul when the beam is broken by a bowling ball because the ball does not break the beam for a long enough duration.

Reset Button

A bowler's reset button is located on the side of the ball rack. This switch parallels the reset switch on the Nexgen Controller box and rear Control Box on the elevator. Its purpose is to cycle the pinsetter to the next ball.

Safety Power Controllers

The Safety Power Controller is installed with pinsetters equipped with the advanced guarding package. The controller interfaces the masking unit and rear door interlock switches and the safety photo sensor and in turn controls the 3 phase power to the Nexgen box. There are three versions of the Safety Controller. Version I and II both incorporate a SICK controller while version III uses a PILZ controller.

Safety Power Controller (Version I and II) Refer to Figures 3-13

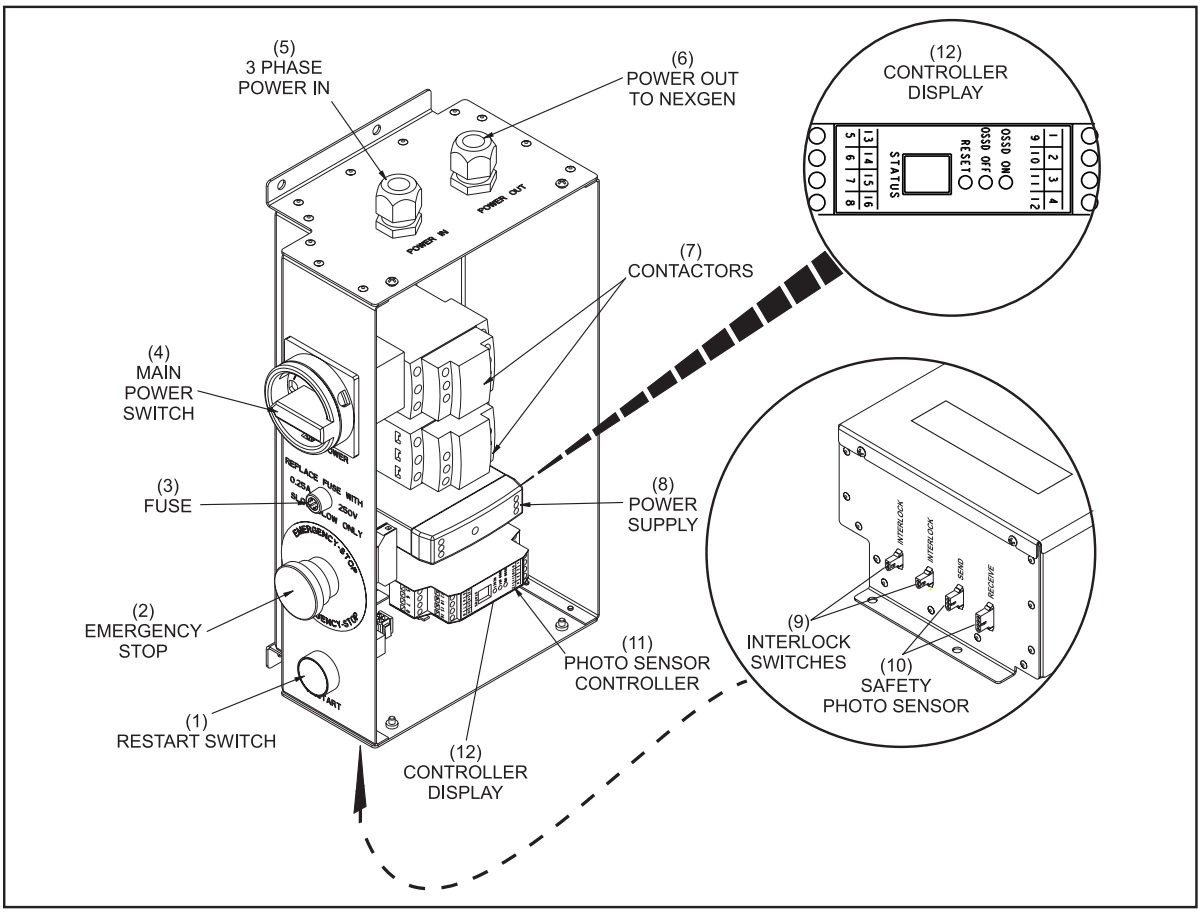


Figure 3-13. Safety Power Controller - Version I and II

(1) **Restart Switch -** Button used to restart the Safety Power Controller box after a power failure or interruption of power caused by opening the guard or masking unit interlock switch or photo sensors.

(2) **Emergency Stop Switch -** Push this button to immediately remove power from the Nexgen box and shut down power to both pinsetters of the lane pair.

(3) **Fuse -** .25A slow blow fuse used to protect power going to the power supply module.

(4) **Main Power Switch -** Controls the 3-phase power entering the box. In the off position, this switch will disconnect power to the Nexgen box and disable both pinsetters and the ball accelerator.

(5) **3 Phase Power In -** Input power connection for the 3-phase power. This voltage can be 208, 230 or 380 - 415 VAC.

(6) **Power Out to Nexgen -** Power conection for 3 phase power to the Nexgen box.

(7) **Contactors -** Power contactors used to disconnect 3 phase power whenever the emergency off switch is pressed or an interlock switch/sensor is tripped

(8) **Power Supply -** DC power supply for the photo sensor controller and the photo sensor receiver and transmitter.

(9) **Interlock Switches -** Connection for the masking unit and rear door interlock swithes. The switches can be plugged into either connector.

(10) **Safety Photo Sensor -** Connection for the safety photo sensor located at the front of the pinsetters. The 3 terminal connector is for the transmitter unit. the 4 terminal connector is for the receiving unit.

(11) **Photo Sensor Controller -** The module that monitors the photo sensor receiver and transmitter and the interlock switches.

(12) **Controller Display -** The photo sensor controller display provides information as to the status of the module and the interlock switches and photo sensors. Refer to Table 5.

Safety Controller Codes - Version I And II

DISPLAY READING	STATUS
OSSD ON ○ GREEN (OFF) OSSD OFF ● RED (ON) RESET ○ YELLOW (OFF)	Safety Controller has power. Sensor misaligned or obstructed.
OSSD ON ○ GREEN (OFF) OSSD OFF ● RED (ON) RESET ● YELLOW (ON)	Safety controller has power. Sensors are aligned and interlocks are connected. Waiting for restart button to be pushed.
OSSD ON ● GREEN (ON) OSSD OFF ○ RED (OFF) RESET ○ YELLOW (OFF)	Nexgen has power and is ready for operation.

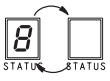
DISPLAY READING	PROBLEM	SOLUTION
OSSD ON ○ GREEN (OFF) OSSD OFF ○ RED (OFF) RESET ○ YELLOW (OFF)	No power to Safety Controller.	1. Turn Control Power switch to ON 2. Check Safety Control power.
OSSD ON ○ GREEN (OFF) OSSD OFF ● RED (ON) RESET ● YELLOW (ON)	Beam from Senor was interrupted.	Press “RESTART” button.
OSSD ON ○ GREEN (OFF) OSSD OFF ● RED (ON) RESET–✳–YELLOW (FLASHING)	Sensor receiver has a weak signal from sender.	1. Check alignment of sensor, receiver and sender lens. 2. Clean sensor receiver and sender lens.
	System Error.	Replace Safety Controller.
OSSD OFF ● RED (ON) RESET ● YELLOW (ON)	Interlock or E-Stop open.	Check interlock and E-stop.
OSSD OFF ● RED (ON) 	Interlock or E-Stop open.	Check interlocks and E-stop. Turn control power switch OFF and ON again. Check Controller and or wiring.
OSSD OFF ● RED (ON)	Sensor wiring Issue	Check wiring of sensors and rectify problem.
	Supply voltage too low.	Check Safety Control power..

Table 5

Safety Power Controller (Version III) Refer to Figures 3-14.

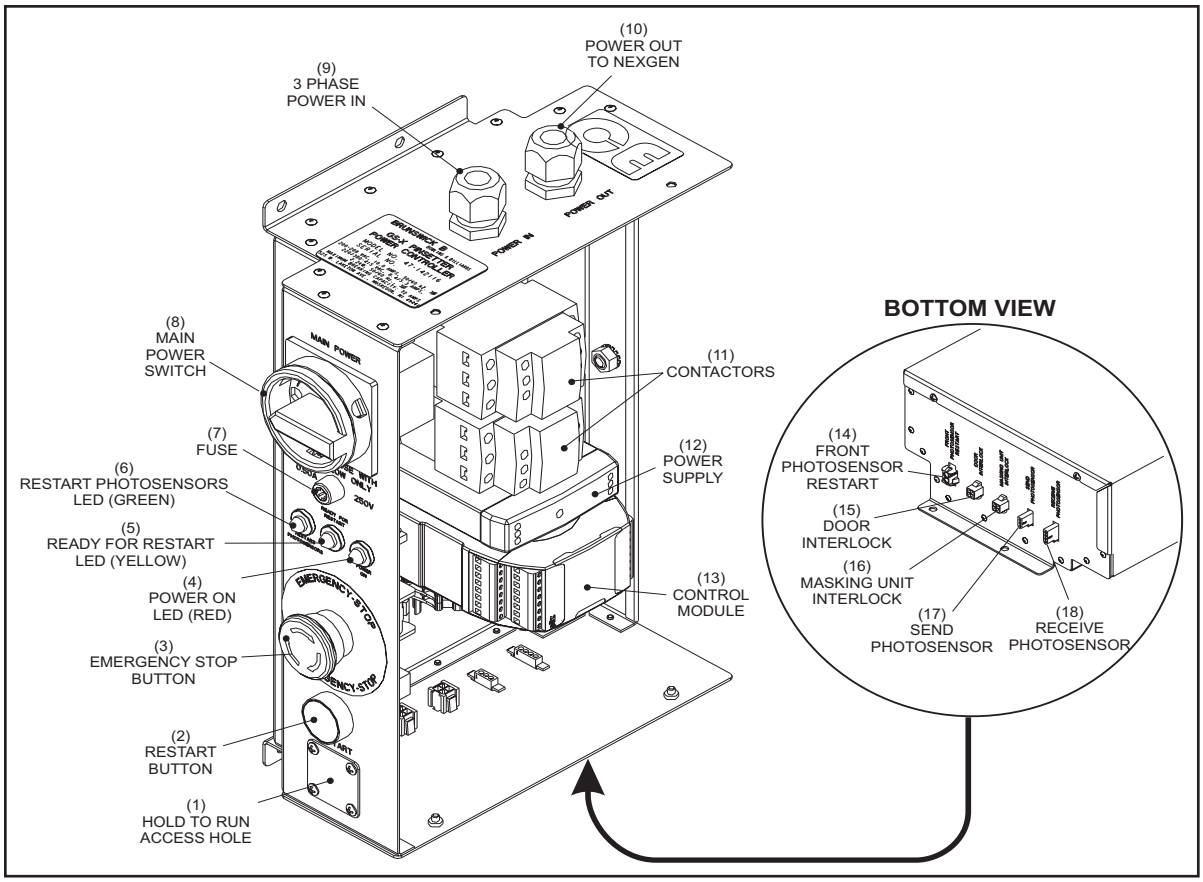


Figure 3-14. Safety Power Controller - Version III

(1) Hold To Run Access Hole - Location to mount the optional Hold-To-Run Switch.

(2) Restart Switch - Button used to restart the Safety Power Controller, as indicated by the yellow restart LED, after a power failure or interruption of power caused by opening the guard or masking unit interlock switch or photo sensors.

(3) Emergency Stop Switch - Push this button to immediately remove power from the Nexgen box and shut down power to both pinsetters of the lane pair.

(4) Power On LED (Red) - This LED Turns “On” when the safety controller has applied power to the Nexgen.

(5) Ready For Restart LED (Yellow) - This LED Turns “On” when all the interlock switches and sensors are in the ready to operate position and the safety controller is ready for a restart. Refer to (2) Restart Switch.

(6) Restart Photo Sensors LED (Green) - This LED Turns “On” when the photosensor beam at the masking unit has been interrupted to indicate that the sensor needs to be restarted. pnce the cause of the interruption has been determined, press the Photosensor Restart button to reset the photosensor circuit

(7) Fuse - .25A slow blow fuse used to protect power going to the power supply module.

(8) **Main Power Switch -** Controls the 3-phase power entering the box. In the off position, this switch will disconnect power to the Nexgen box and disable both pinsetters and the ball accelerator.

(9) **3 Phase Power In -** Input power connection for the 3-phase power. This voltage can be 208, 230 or 380 - 415 VAC.

(10) **Power Out to Nexgen -** Power conection for 3 phase power to the Nexgen box.

(11) **Contactors -** Power contactors used to disconnect 3 phase power whenever the emergency off switch is pressed or an interlock switch/sensor is tripped

(12) **Power Supply -** DC power supply for the photo sensor controller and the photo sensor receiver and transmitter.

(13) **Controller -** The module that monitors the photo sensor receiver and transmitter and the interlock switches. The display on the controller provides information as to the status of the module and the interlock switches and photo sensors. Refer to Table 6.

(14) **Front Photosensor Restart -** Connection for the photosensor restart button. The button is typically located on the back of the odd lane pinsetter, under the nexgen display, but may be mounted at the front of the pinsetters on the making unit frame.

(15) **Door Interlock -** Connection rear door interlock switches.

(16) **Masking Unit Interlock -** Connection for the masking unit.

(17) **Send Photo Sensor -** Connection for the safety photo sensor transmitter unit located at the front of the pinsetters.

(18) Receive Photo Sensor - Connection for the photosensor receiving unit located at the front of the pinsetters.

Safety Controller Codes - Version III

DISPLAY READING	STATUS
● GREEN (ON) ○ YELLOW (OFF) ○ RED (OFF)	The front Sensors are correctly aligned. Safety controller has power.
○ GREEN (OFF) ● YELLOW (ON) ○ RED (OFF)	Masking unit and ball return door interlocks are closed. Emergency stop button is not pressed.
○ GREEN (OFF) ○ YELLOW (OFF) ● RED (ON)	Nexgen has power and is ready for operation.

DISPLAY READING	PROBLEM	SOLUTION
OSSD ON ○ GREEN (OFF) OSSD OFF ○ RED (OFF) RESET ○ YELLOW (OFF)	No power to Safety Controller.	1. Turn Control Power switch to ON 2. Check Safety Control power.
OSSD ON ○ GREEN (OFF) OSSD OFF ● RED (ON) RESET ● YELLOW (ON)	Beam from Senor was interrupted.	Press “RESTART” button.
OSSD ON ○ GREEN (OFF) OSSD OFF ● RED (ON) RESET ✳ YELLOW (FLASHING)	Sensor receiver has a weak signal from sender.	1. Check alignment of sensor, receiver and sender lens. 2. Clean sensor receiver and sender lens.
E STATUS	System Error.	Replace Safety Controller.
OSSD OFF ● RED (ON) RESET ● YELLOW (ON) 8 STATUS	Interlock or E-Stop open.	Check interlock and E-stop.
OSSD OFF ● RED (ON) 8 STATUS □ STATUS	Interlock or E-Stop open.	Check interlocks and E-stop. Turn control power switch OFF and ON again. Check Controller and or wiring.
OSSD OFF ● RED (ON) A STATUS 2 STATUS	Sensor wiring Issue	Check wiring of sensors and rectify problem.
L STATUS 9 STATUS	Supply voltage too low.	Check Safety Control power..

Table 6

Pinsetter Power-up Procedure - Version III Safety Controller

1. Verify that the photosensors are aligned with no obstructions, the masking unit and ball return door interlocks switches are closed and the emergency stop switch on the safety controller in not activated (Twist the E-stop button to deactivate). Turn main power switch to the "On"
position.

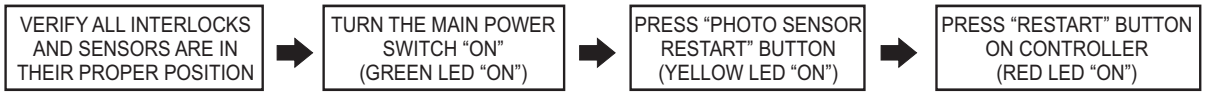
   - The safety controller will start an initial power up diagnostics to verify conditions.
   - The green "Restart Photosensor" LED will illuminate.

2. Press the photosensor restart button to activate the photosensor located on the masking unit.

   - The green LED will go off and the yellow "Ready for Restart" LED will illuminate.

3. Press the blue "Restart" button located on the GS-X Safety Controller box to activate the interlock switches.

   - The yellow LED will go off and the red "Power On" LED will illuminate.
   - Power will be supplied to the GS-X Nexgen.


VERIFY ALL INTERLOCKS AND SENSORS ARE IN THEIR PROPER POSITION
TURN THE MAIN POWER SWITCH "ON" (GREEN LED "ON")
PRESS "PHOTO SENSOR RESTART" BUTTON (YELLOW LED "ON")
PRESS "RESTART" BUTTON ON CONTROLLER (RED LED "ON")

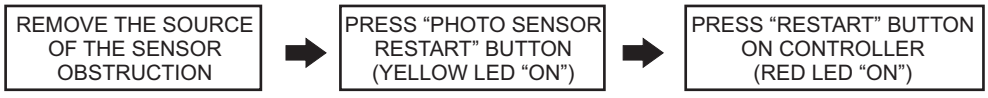
Pinsetter Restart Procedure - Version III Safety Controller

The photo sensor has been obstructed (Green, "Restart Photosensor" LED, "ON")

1. Remove obstruction from photosensors.

2. Press the photosensor restart button to re-activate the photosensors.

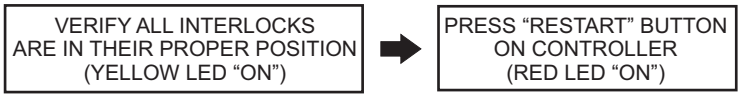
3. Press the blue "Restart" button located on the GS-X Safety Controller box.


REMOVE THE SOURCE OF THE SENSOR OBSTRUCTION
PRESS "PHOTO SENSOR RESTART" BUTTON (YELLOW LED "ON")
PRESS "RESTART" BUTTON ON CONTROLLER (RED LED "ON")

The Ball Return Interlock or Masking Unit Interlock is triggered.

1. Return the masking unit and/or the ball return access door to the "closed" position.

2. Press the blue "Restart" button located on the GS-X Safety Controller box to re-activate the interlock switches.



Remote Display

The mechanic's remote display allows setup and diagnostics for the both pinsetters. Figures 3-15.

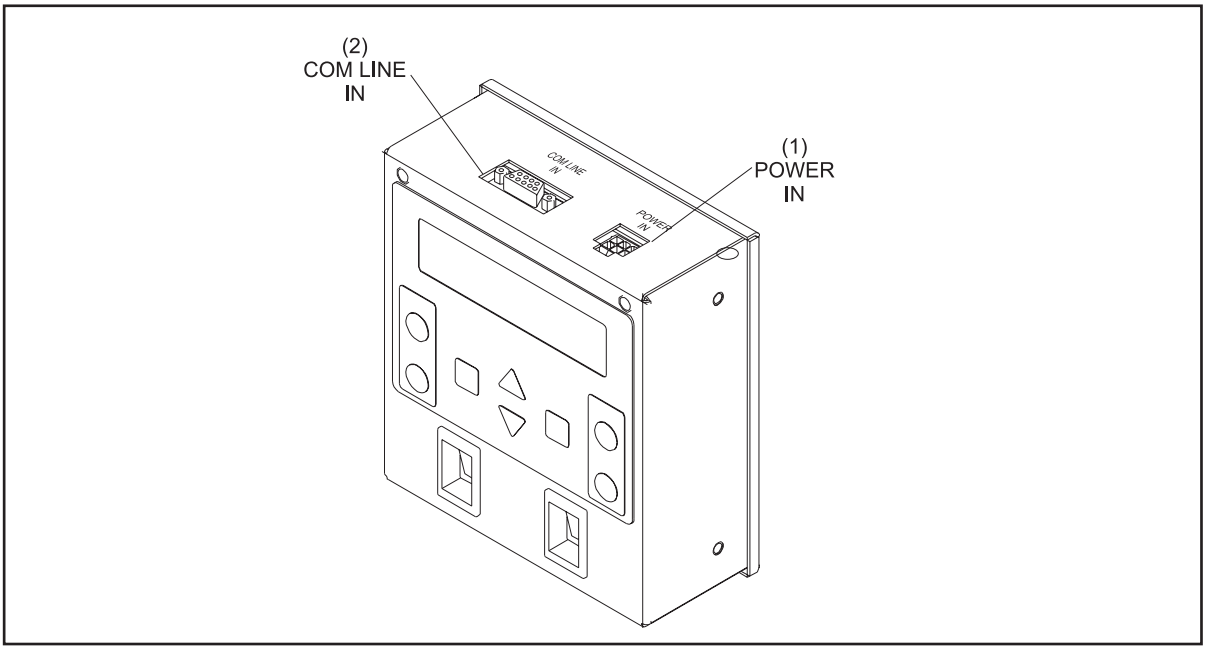


Figure 3-15 Remote Display

(1) Power In - This connection provide power for the display and connects the stop/run switches to the Nexgen Controller.

(2) Comline In - Connection for communication coming from the auxillary comline connection of the Nexgen Controller.

CABLES AND WIRING

Cable Connections

The Nexgen box interconnects with several external devices that assist in the operation of the pinsetters.

The cables are labeled for easy identification in the event the Nexgen box needs to be replaced. However, care must be exercised when making these changes as problems can occur if cables are swapped between the left and right connections. Refer to *Figure 3-15.*

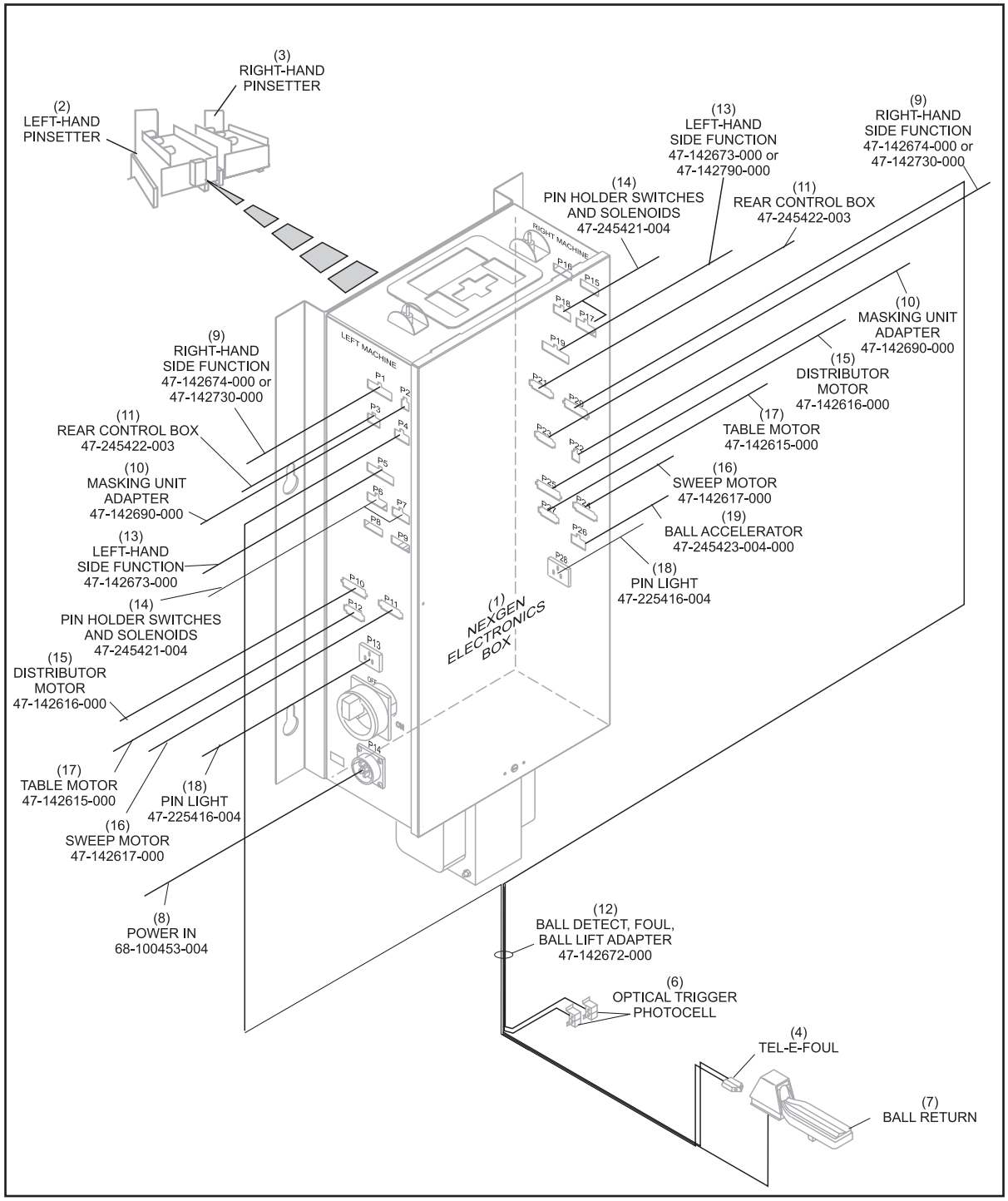


Figure 3-16. GS-Series Pinsetters with Nexgen Electronics.

(1) NEXGEN ELECTRONIC BOX
(2) LEFT-HAND PINSETTER
(3) RIGHT-HAND PINSETTER
(4) TEL-E-FOUL
(5) BALL ACCELERATOR 47-245423-004
(6) OPTICAL TRIGGER PHOTOCELL
(7) BALL RETURN
(8) POWER IN 68-100453-004
(9) RIGHT-HAND SIDE FUNCTION 47-142674-000 OR 47-142730-000
(10) MASKING UNIT ADAPTER 47-142690-000
(11) REAR CONTROL BOX 47-245422-003
(12) BALL DETECT, FOUL, BALL LIFT ADAPTER 47-142672-000
(13) LEFT-HAND SIDE FUNCTION 47-142673-000 OR 4 7-142790-000
(14) PIN HOLDER SWITCHES AND SOLENOID 47-245421-004
(15) DISTRIBUTOR MOTOR 47-142616-000
(16) SWEEP MOTOR 47-142617-000
(17) TABLE MOTOR 47-142615-000
(18) PIN LIGHT 47-225416-004

Intentionally Blank

TRANSFORMER 1		
Input Voltage	Wire	High Voltage PCB Terminal
220V 380V 415V	BLK	J37
	BLK/RED	J25
	BLK/WHT	Not Used
	BLK/YEL	J42
208V	BLK	J37
	BLK/YEL	J25
	BLK/RED	J42
	BLK/WHT	Not Used
200V	BLK	J37
	BLK/WHT	J25
	BLK/YEL	J42
	BLK/RED	Not Used

TRANSFORMER 2		
Input Voltage	Wire	High Voltage PCB Terminal
220V 380V 415V	BLK	J37
	BLK/RED	J25
	BLK/WHT	Not Used
	BLK/YEL	J43
208V	BLK	J37
	BLK/YEL	J25
	BLK/RED	J43
	BLK/WHT	Not Used
200V	BLK	J37
	BLK/WHT	J25
	BLK/YEL	J43
	BLK/RED	Not Used

Figure 3-16. Nexgen Controller with Advanced Guards and Remote Display

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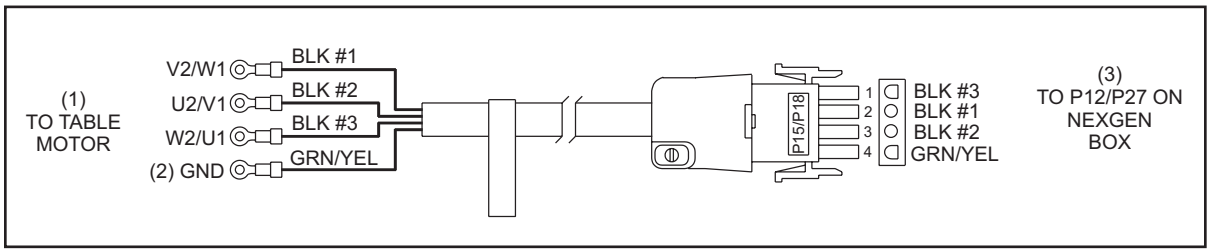
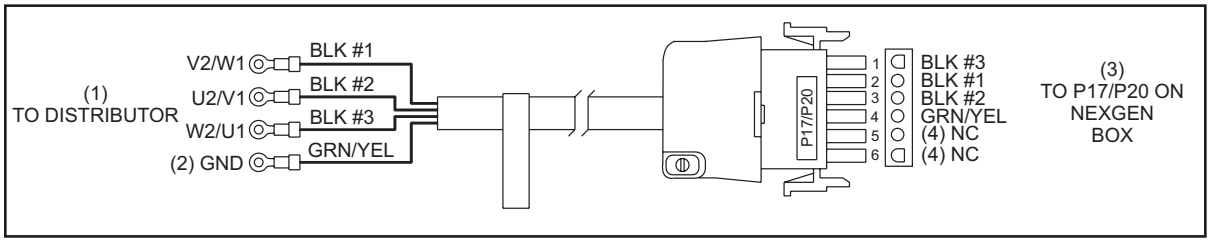


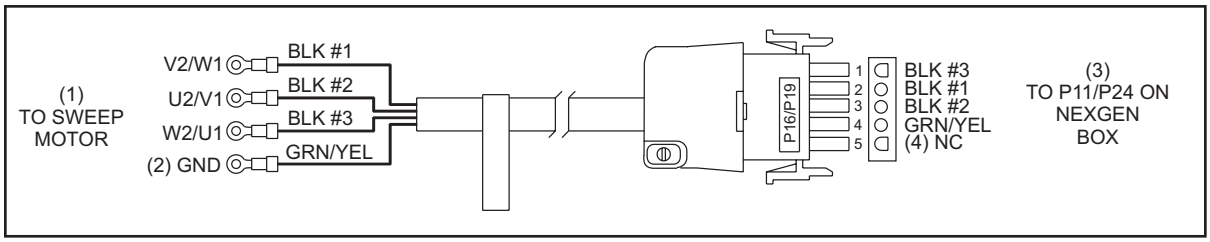
47-142615-000 - External Table Motor Cable Assembly

(1) TO TABLE MOTOR (2) GROUND (3) TO P15/P18 ON NEXGEN BOX



47-142616-000 - External Distributor Motor Cable Assembly

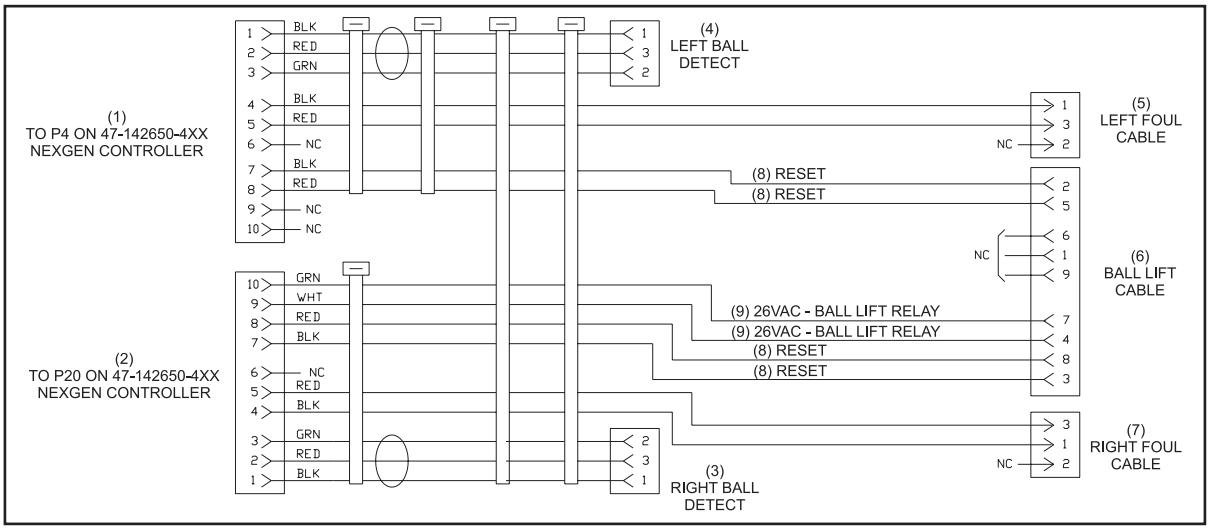
(1) TO DISTRIBUTOR (2) GROUND (3) TO P17/P20 ON NEXGEN BOX
)4) NO CONNECTION



47-142617-000 - Sweep Motor Cable Assembly

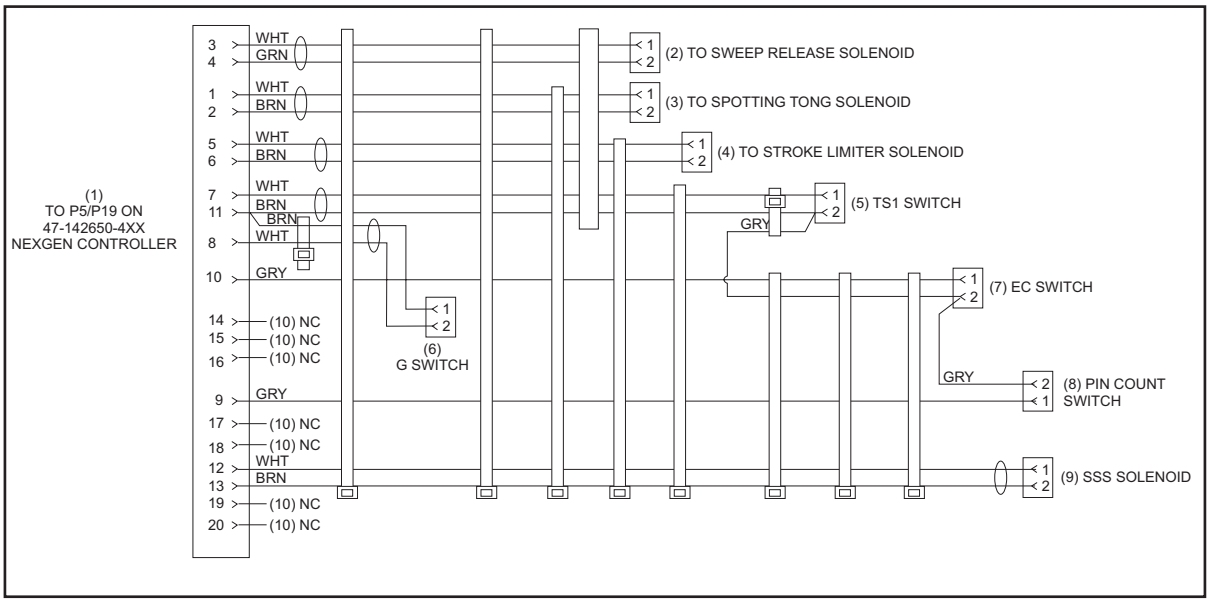
(1) TO SWEEP MOTOR NEXGEN BOX (2) GROUND (3) TO P11/P24 ON GS

(4) NO CONNECTION



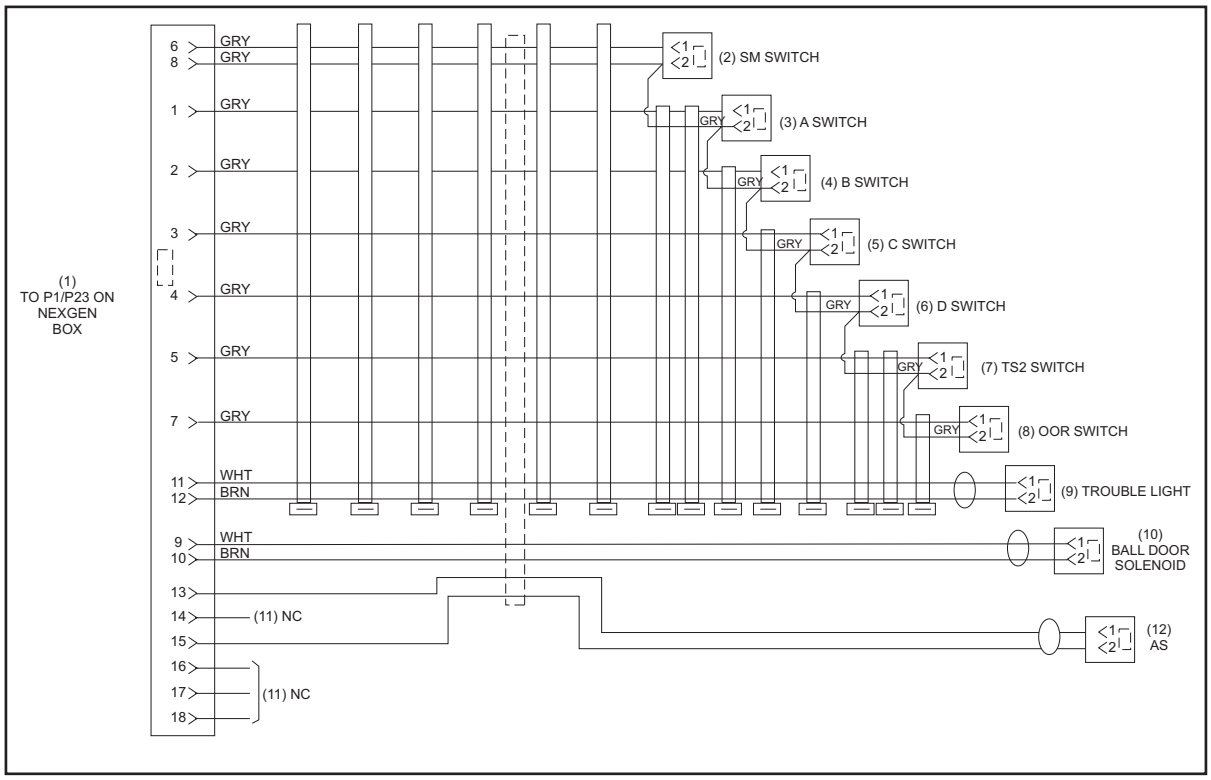
47-142672-000 Ball Detect/Foul Cable

(1) TO P4 ON 47-142650-4XX NEXGEN CONTROLLER
(2) TO P20 ON 47-142650-4XX NEXGEN CONTROLLER
(3) RIGHT BALL DETECT
(4) LEFT BALL DETECT
(5) LEFT FOUL CABLE
(6) BALL LIFT CABLE
(7) RIGHT FOUL CABLE



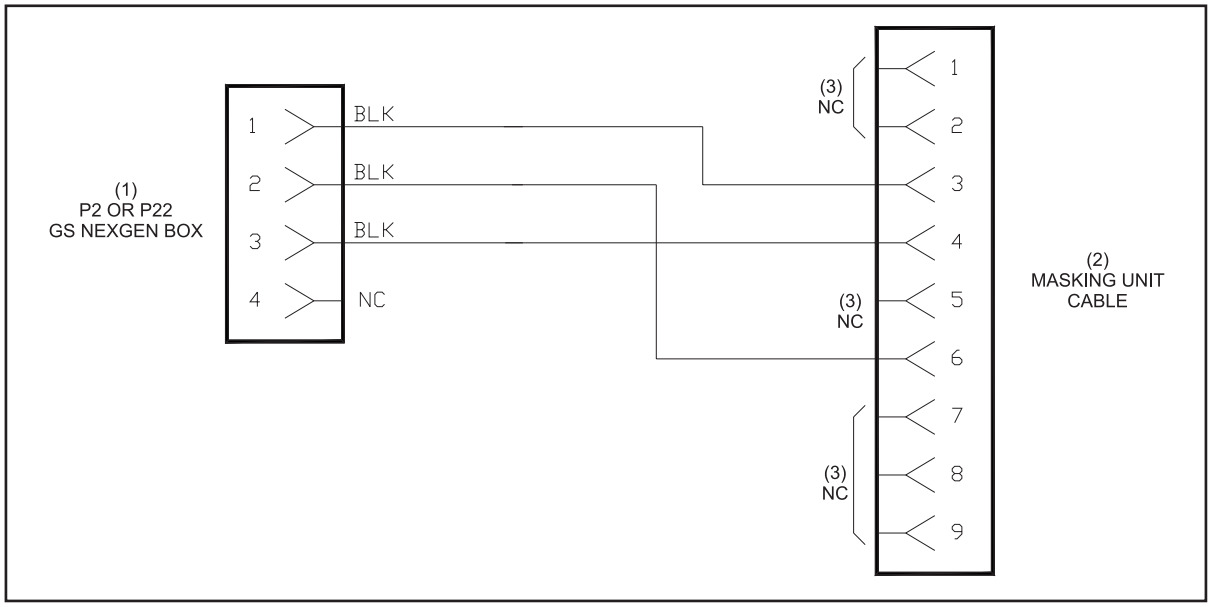
47-142673-000 - Left Side Function Cable

(1) TO P5/P19 ON NEXGEN CONTROLLER
(2) TO SWEEP RELEASE SOLENOID
(3) TO SPOTTING TONG SOLENOID
(4) TO STROKE LIMITER SOLENOID
(5) TS1 SWITCH
(6) G SWITCH
(7) EC SWITCH
(8) PIN COUNT SWITCH
(9) SHARK SOLENOID
(10) NO CONNECTION



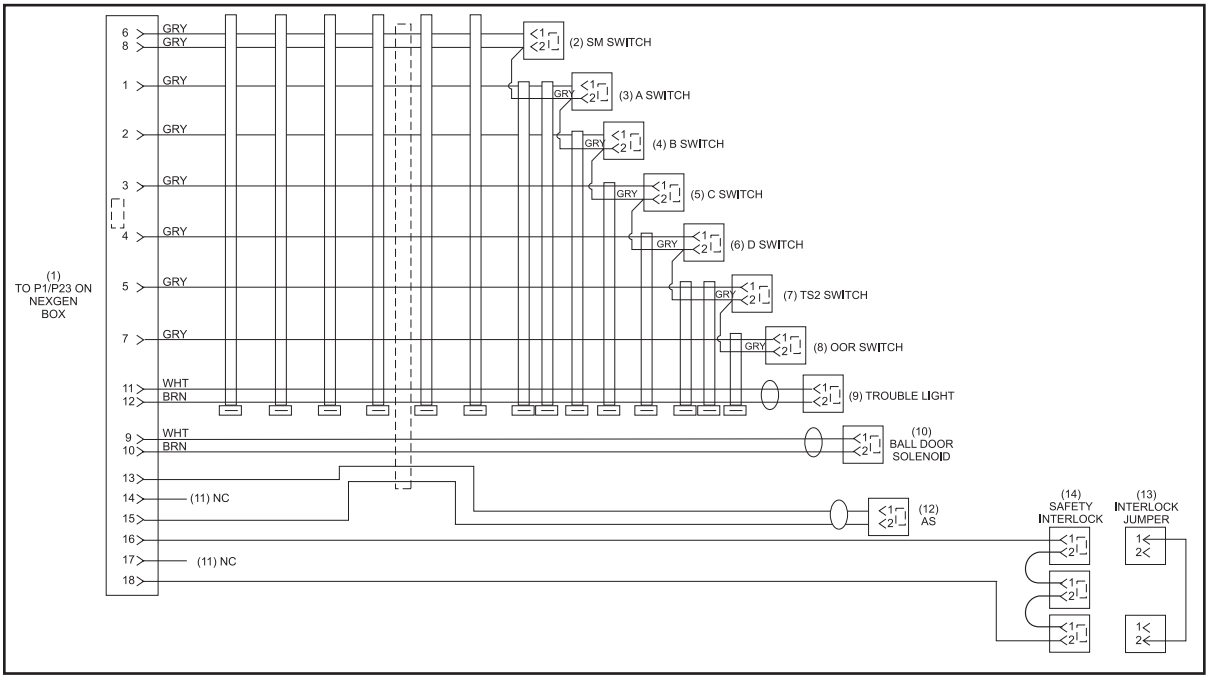
47-142674-000 - Right Side Function Cable

(1) TO P1/P3 NEXGEN BOX
(2) SM SWITCH
(3) A SWITCH
(4) B SWITCH
(5) C SWITCH
(6) D SWITCH
(7) TS2 SWITCH
(8) OOR SWITCH
(9) TROUBLE LIGHT
(10) BALL DOOR SOLENOID
(11) NO CONNECTION
(12) AS



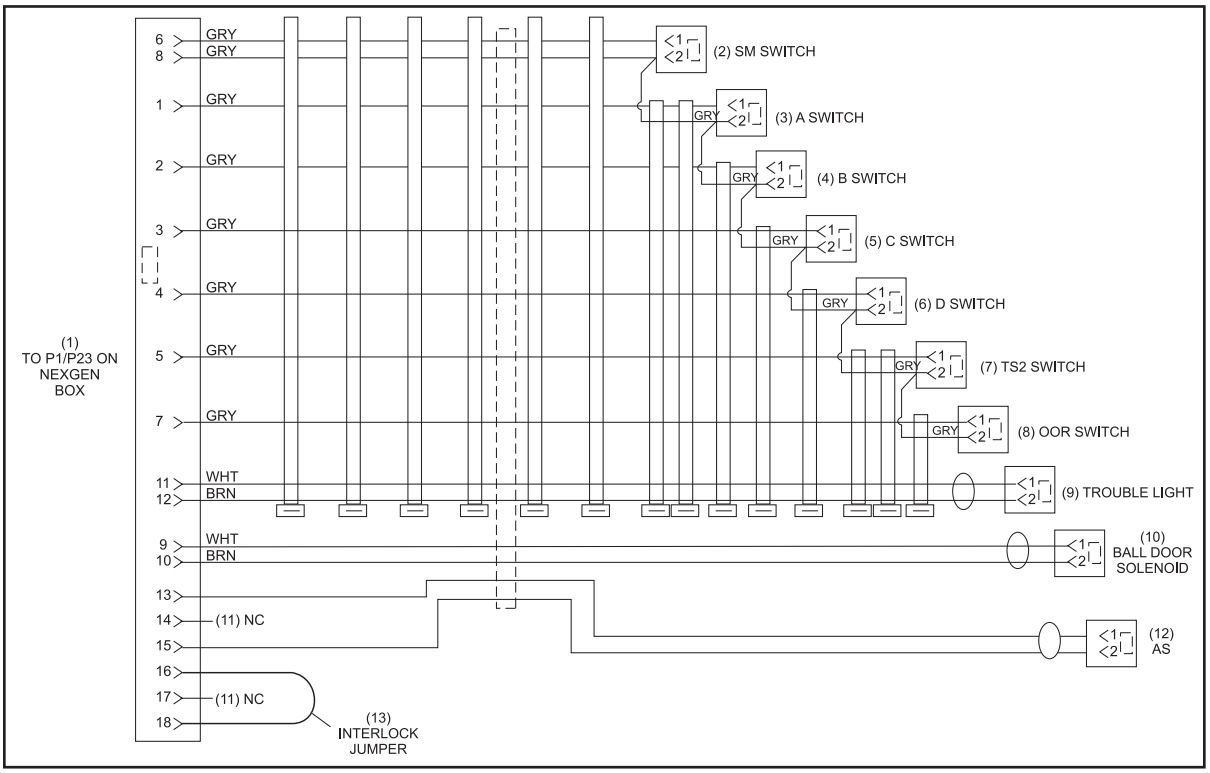
47-142690-000 - Masking Unit Adapter GS Nexgen

(1) TO P2 OR P22 NEXGEN BOX
(2) MASKING UNIT CABLE
(3) NO CONNECTION



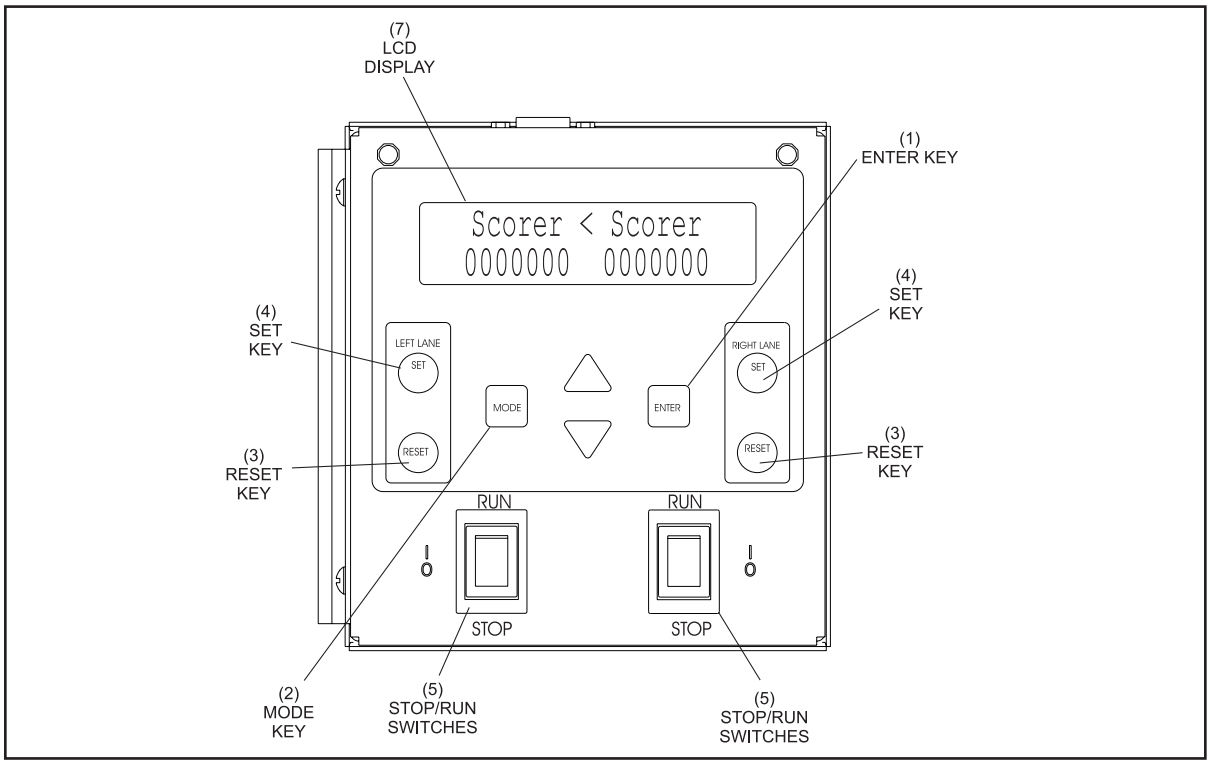
47-142730-000 - Right Side Function Cable Assembly (Revision B)

(1) TO P1/P3 NEXGEN BOX
(2) SM SWITCH
(3) A SWITCH
(4) B SWITCH
(5) C SWITCH
(6) D SWITCH
(7) TS2 SWITCH
(8) OOR SWITCH
(9) TROUBLE LIGHT
(10) BALL DOOR SOLENOID
(11) NO CONNECTION
(12) AS
(13) INTERLOCK JUMPER



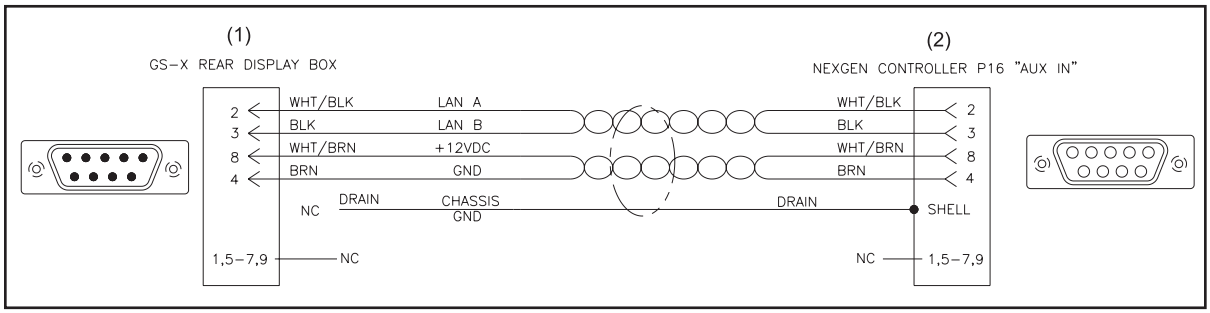
47-142730-000 - Right Side Function Cable Assembly (Revision C)

(1) TO P1/P3 NEXGEN BOX
(2) SM SWITCH
(3) A SWITCH
(4) B SWITCH
(5) C SWITCH
(6) D SWITCH
(7) TS2 SWITCH
(8) OOR SWITCH
(9) TROUBLE LIGHT
(10) BALL DOOR SOLENOID
(11) NO CONNECTION
(12) AS
(13) INTERLOCK JUMPER



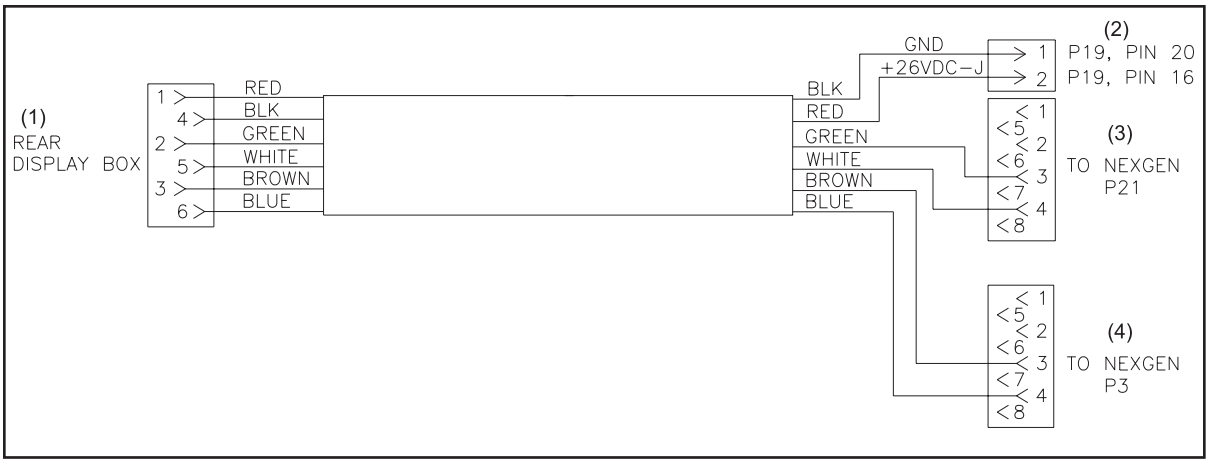
47-142750-4XX - Rear Display

(1) LCD MODULE
(2) RUN/STOP SWITCH RIGHT-HAND
(3) RUNSTOPSWITCH LEFT-HAND
(4) GS-X DISPLAY PCB
(5) KEYPAD MEMBRANE



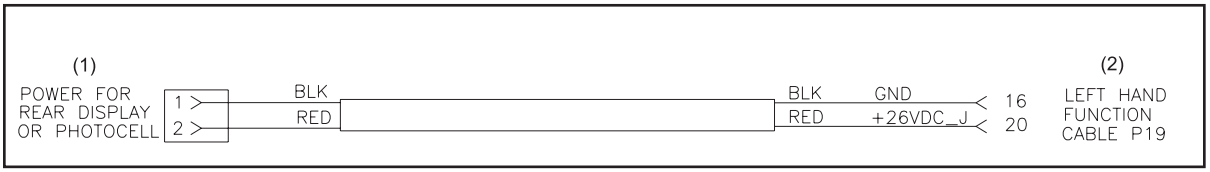
47-142761-000 - GS-X Display to Nexgen Cable Assembly (Pinsetter Series XXX - XXX)

(1) REAR DISPLAY BOX
(2) GROUND
(3) P19, PIN 2C P19, PIN 16
(4) TO NEXGEN P21
(5) TO NEXGEN P3



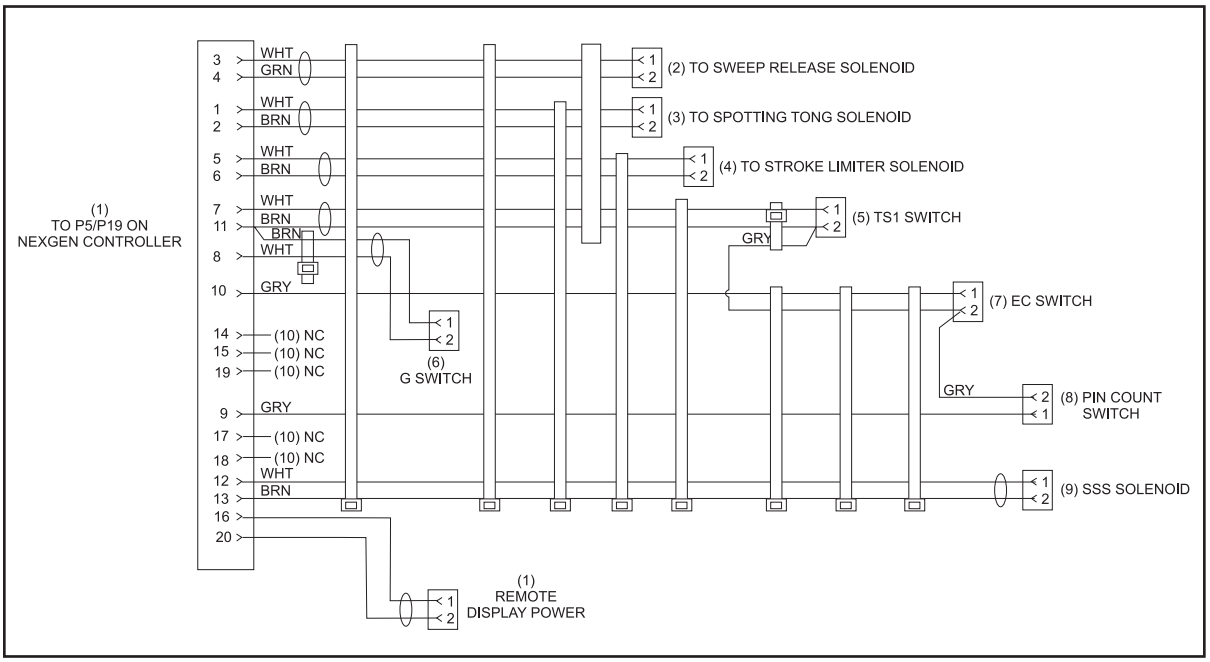
47-142762-000 - GS-X Rear Display Power, Stop Switches

(1) LAN A
(2) LAN B
(3) GROUND
(4) CHASSIS GROUND
(5) DRAIN
(6) NO CONNECTION
(7) SHELL
(8) GS-X DISPLAY BOX
(9) NEXGEN CONTROLLER TO P16



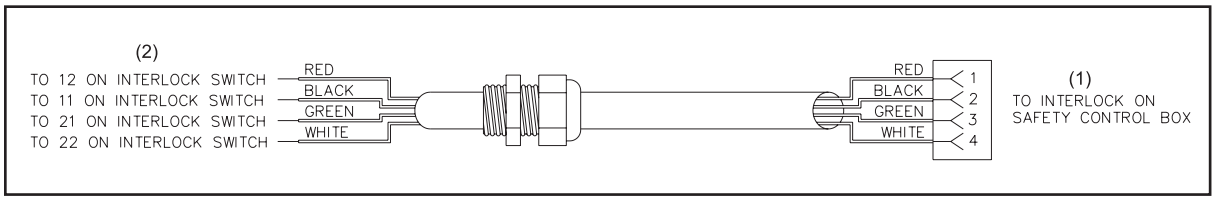
47-142768-000 - GS-X Left Hand Function, Power Retrofit

(1) POWER FOR REAR DISPLAY
(2) LEFT HAND FUNCTION CABLE P19



47-142790-000 - Left Side Function Cable

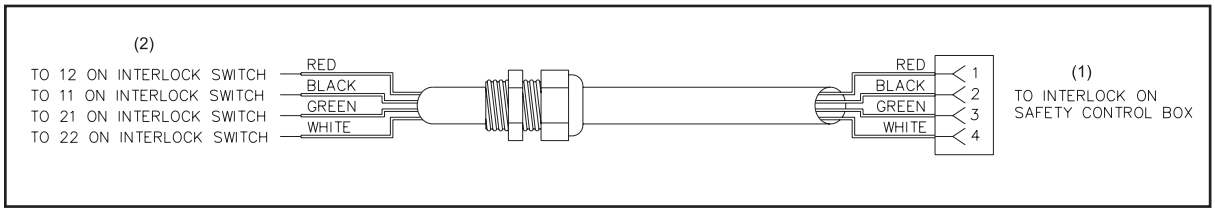
(1) TO P5/P19 ON NEXGEN CONTROLLER
(2) TO SWEEP RELEASE SOLENOID
(3) TO SPOTTING TONG SOLENOID
(4) TO STROKE LIMITER SOLENOID
(5) TS1 SWITCH
(6) G SWITCH
(7) EC SWITCH
(8) PIN COUNT SWITCH
(9) SHARK SOLENOID
(10) NO CONNECTION



47-142861-000 - Masking Unit Interlock Cable Assembly

(1) TO INTERLOCK ON SAFETY CONTROL BOX

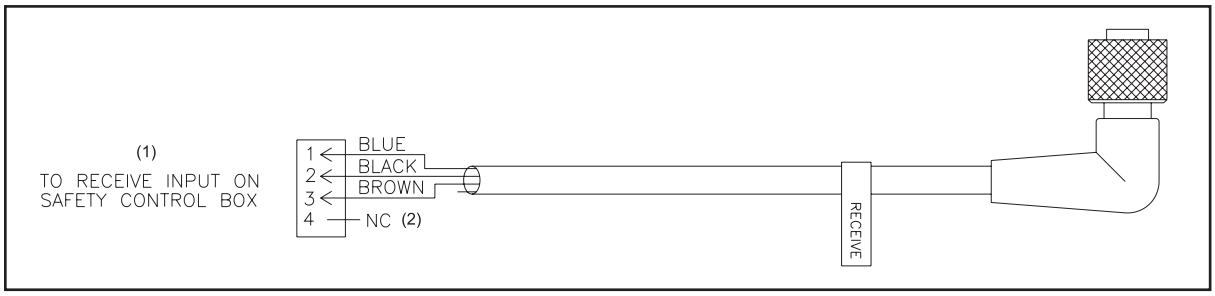
(2) TO 12 ON INTERLOCK SWITCH
TO 11 ON INTERLOCK SWITCH
TO 21 ON INTERLOCK SWITCH
TO 22 ON INTERLOCK SWITCH



47-142862-000 - Door Interlock Switch Cable Assembly

(1) TO INTERLOCK ON SAFETY CONTROL BOX

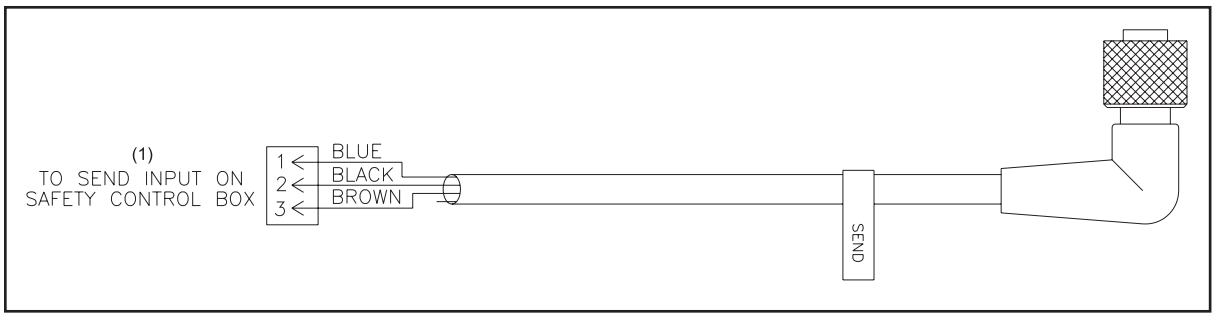
(2) TO 12 ON INTERLOCK SWITCH
TO 11 ON INTERLOCK SWITCH
TO 21 ON INTERLOCK SWITCH
TO 22 ON INTERLOCK SWITCH



47-142863-000 - Photosensor Receiver cable Assembly

(1) TO RECEIVER INPUT ON SAFEETY CONTROLLER BOX

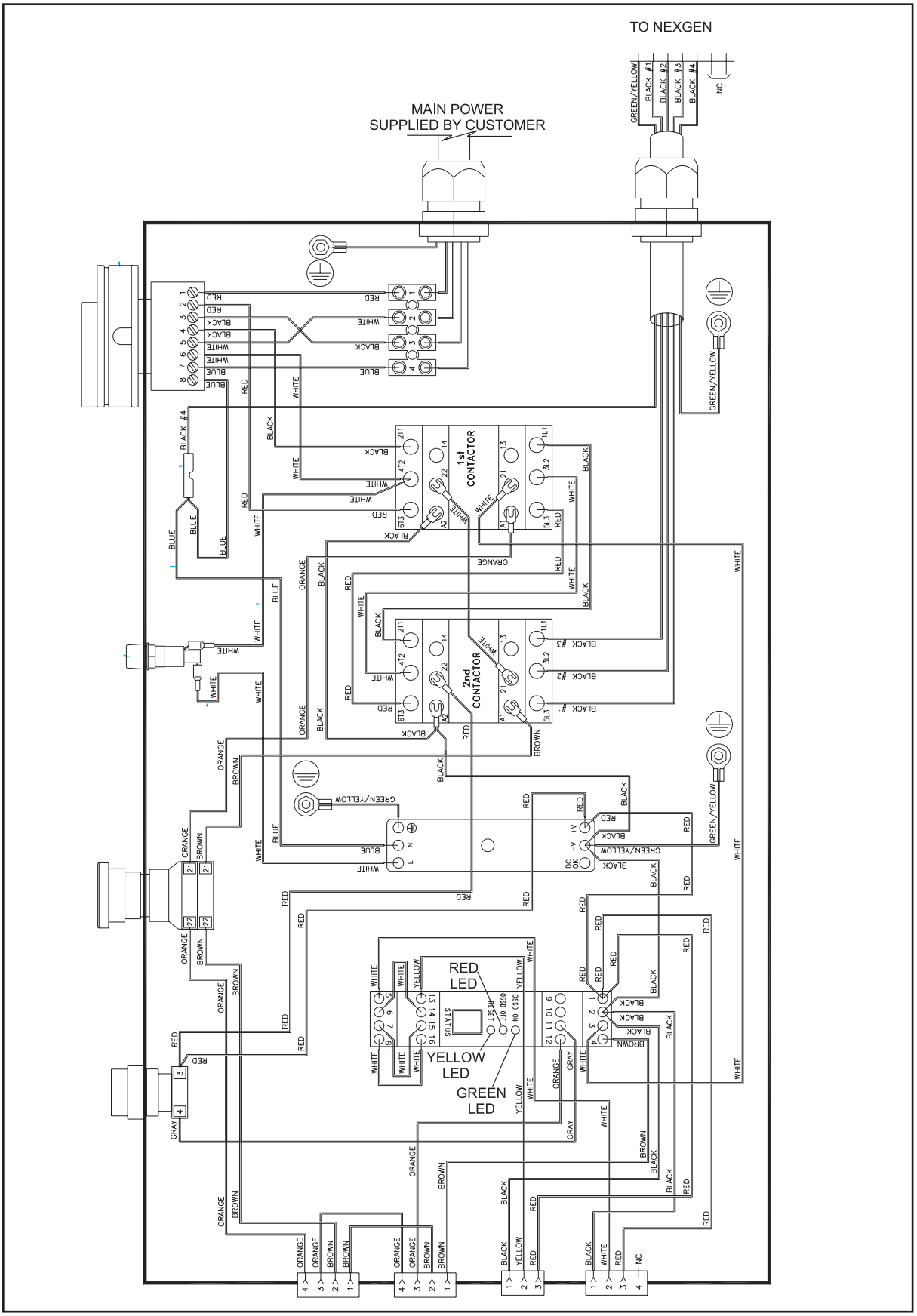
(2) NO CONNECTION



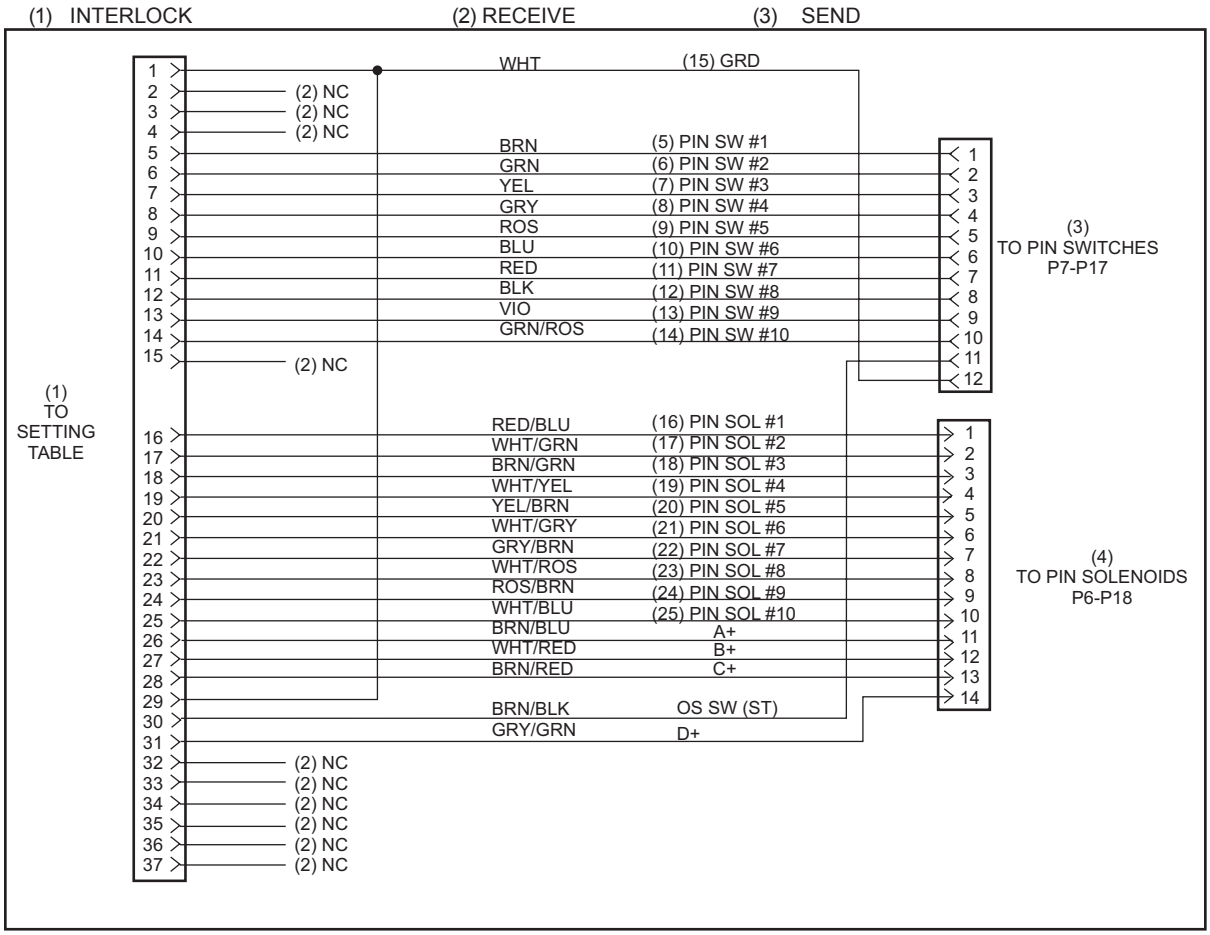
47-142864-000 - Photosensor Send Cable Assembly

(1) TO RECEIVER INPUT ON SAFETY CONTROLLER BOX

(2) NO CONNECTION

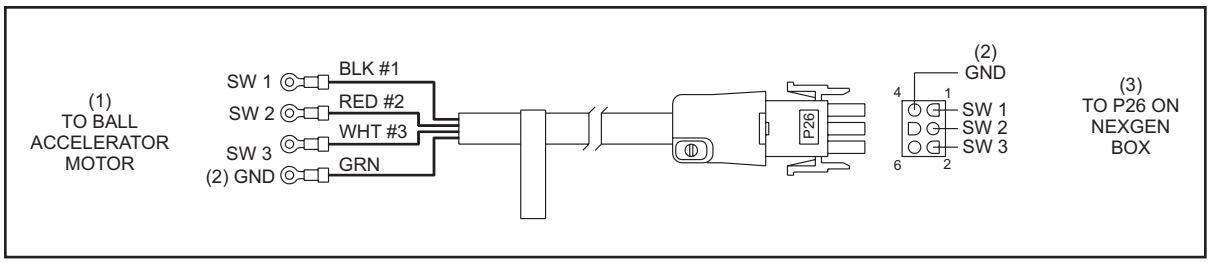


47-142834-000 - CE Safety Power Controller



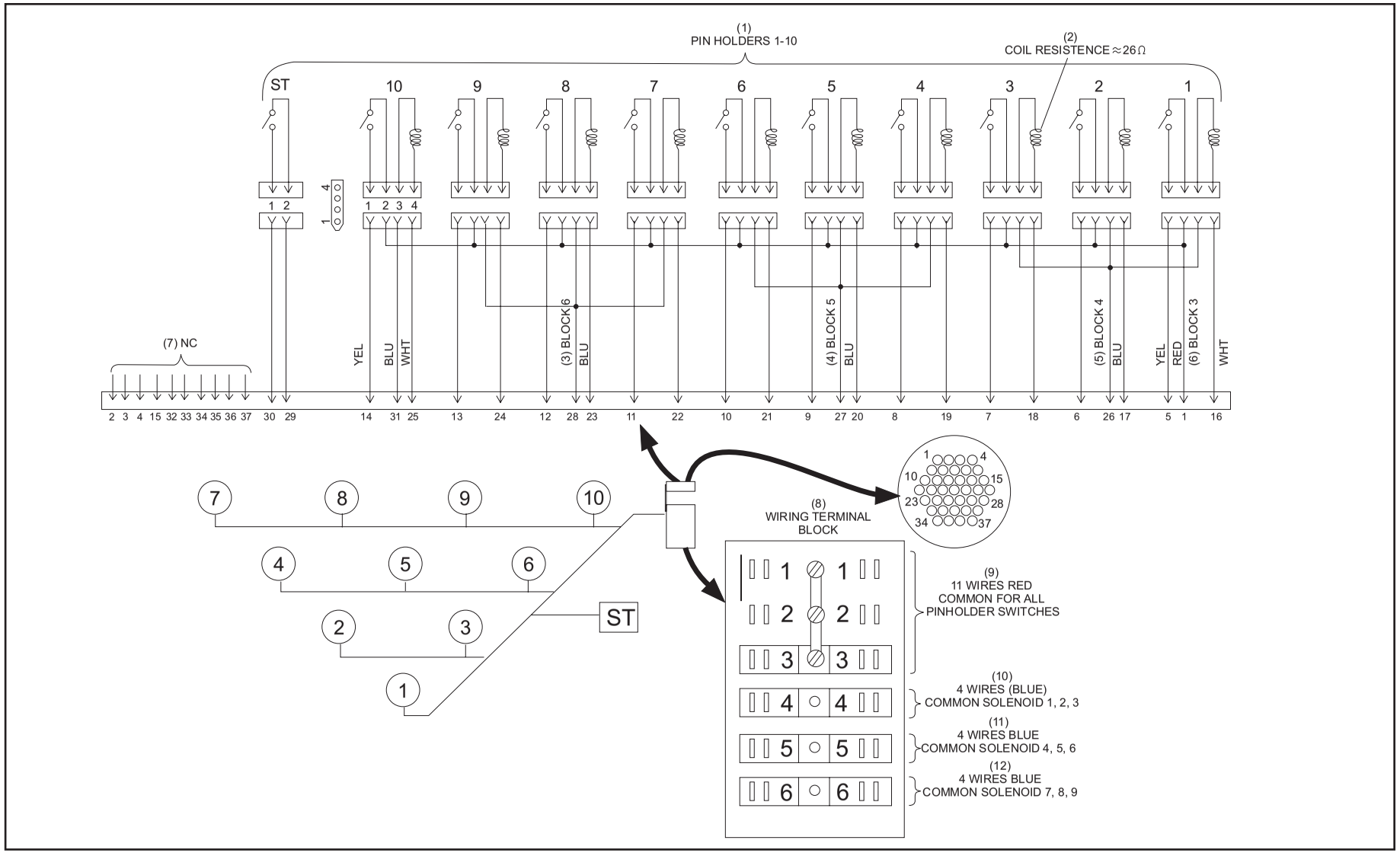
47-245421-004 - External Setting Table Cable Assembly

(1) TO SETTING TABLE
(2) NO CONNECTION
(3) TO PIN SWITCHES P7-P17
(4) TO PIN SOLENOIDS P6-P18
(5) PIN SWITCH #1
(6) PIN SWITCH #2
(7) PIN SWITCH #3
(8) PIN SWITCH #4
(9) PIN SWITCH #5
(10) PIN SWITCH #6
(11) PIN SWITCH #7
(12) PIN SWITCH #8
(13) PIN SWITCH #9
(14) PIN SWITCH #10
(15) GROUND
(16) PIN SOL #1
(17) PIN SOL #2
(18) PIN SOL #3
(19) PIN SOL #4
(20) PIN SOL #5
(21) PIN SOL #6
(22) PIN SOL #7
(23) PIN SOL #8
(24) PIN SOL #9
(25) PIN SOL #10



47-245423-004 - Ball Accelerator Motor Cable Assembly

(1) TO BALL ACCELERATOR MOTOR
(2) GROUND
(3) TO P26 ON NEXGEN BOX



47-245585-003 - Setting Table Cable Assembly

(1) PIN HOLDERS 1-10

(2) COIL RESISTANCE ALMOST EQUAL TO 26 OHMS

(3) BLOCK

(4) BLOCK 5

(5) BLOCK 4

(6) BLOCK 3

(7) NO CONNECTION

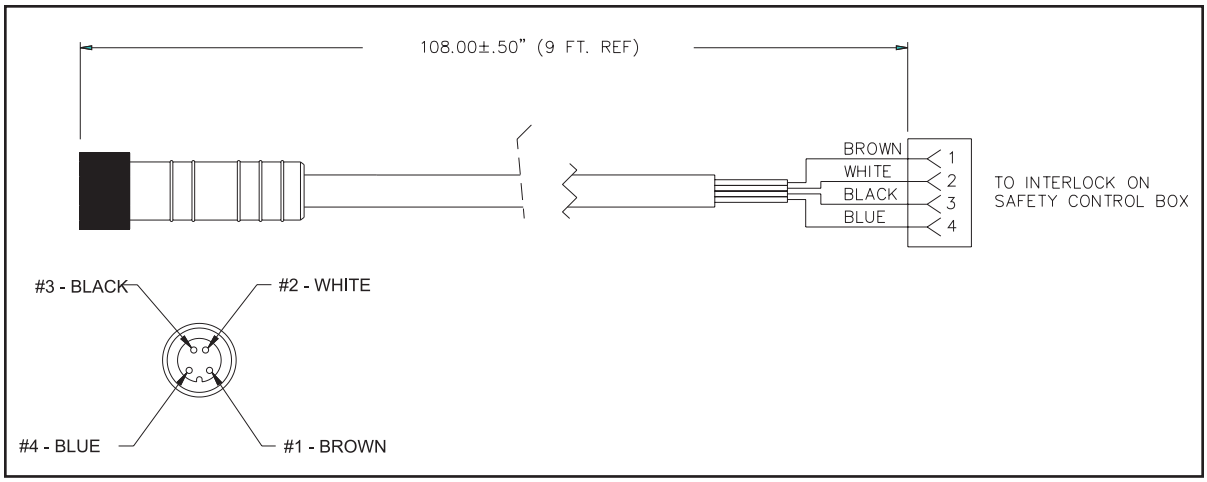
(8) WIRING TERMINAL BLOCK

(9) 11 WIRES RED COMMON FOR ALL PINHOLDER SWITCHES

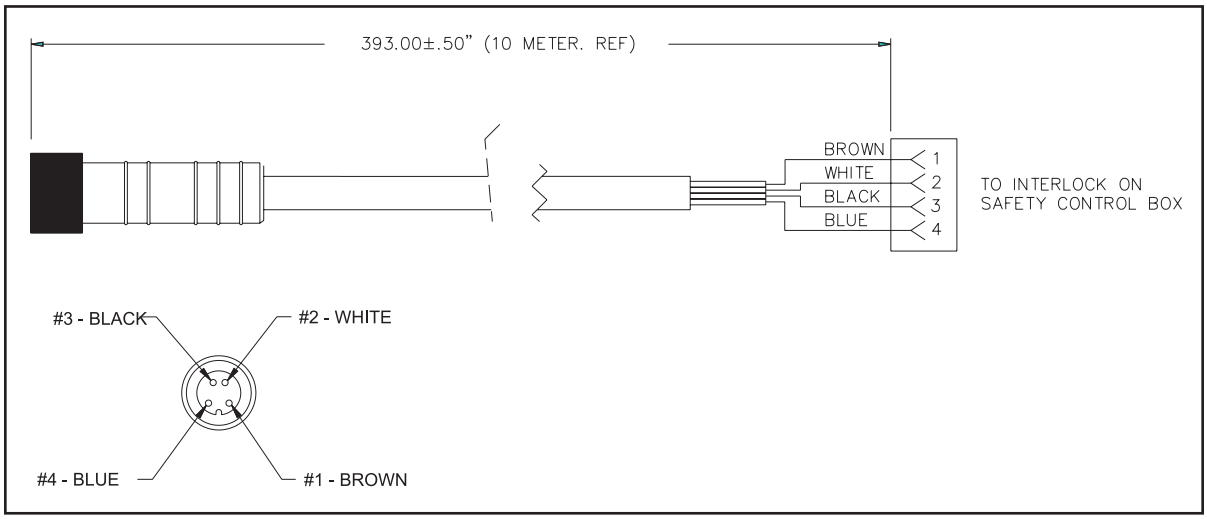
(10) 4 WIRES (BLUE) COMMON SOLENOID 1, 2, 3

(11) 4 WIRES BLUE COMMON SOLENOID 4, 5, 6

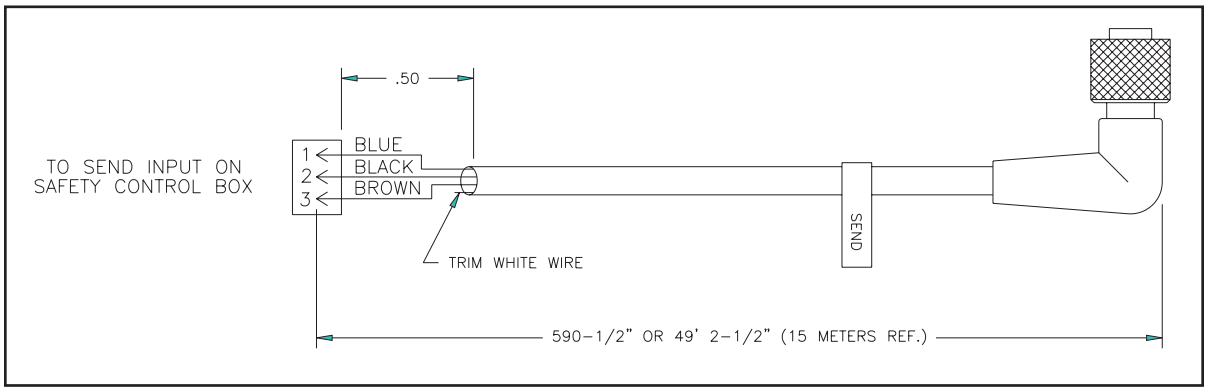
(12) 4 WIRES BLUE COMMON SOLENOID 7, 8, 9



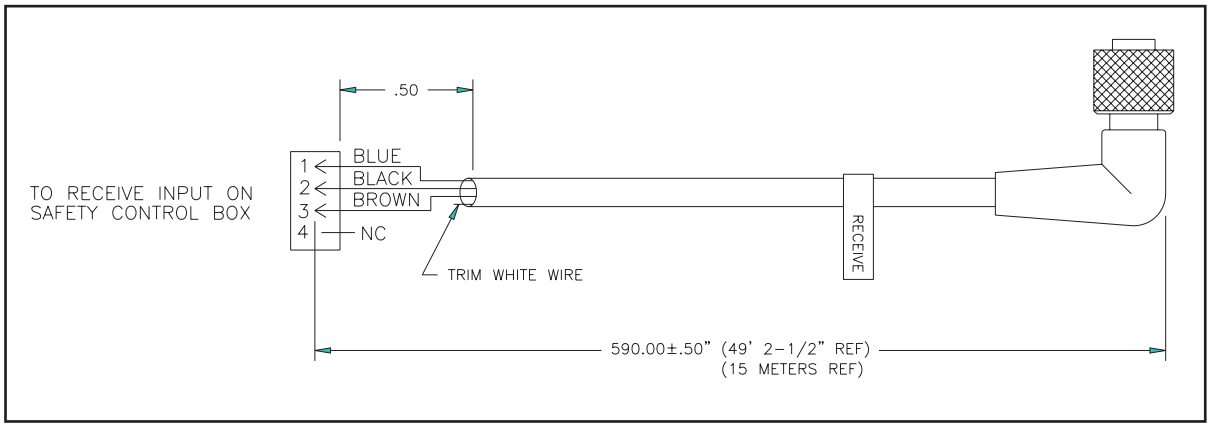
47-142880-000 - Rear Gate Interlock Cable



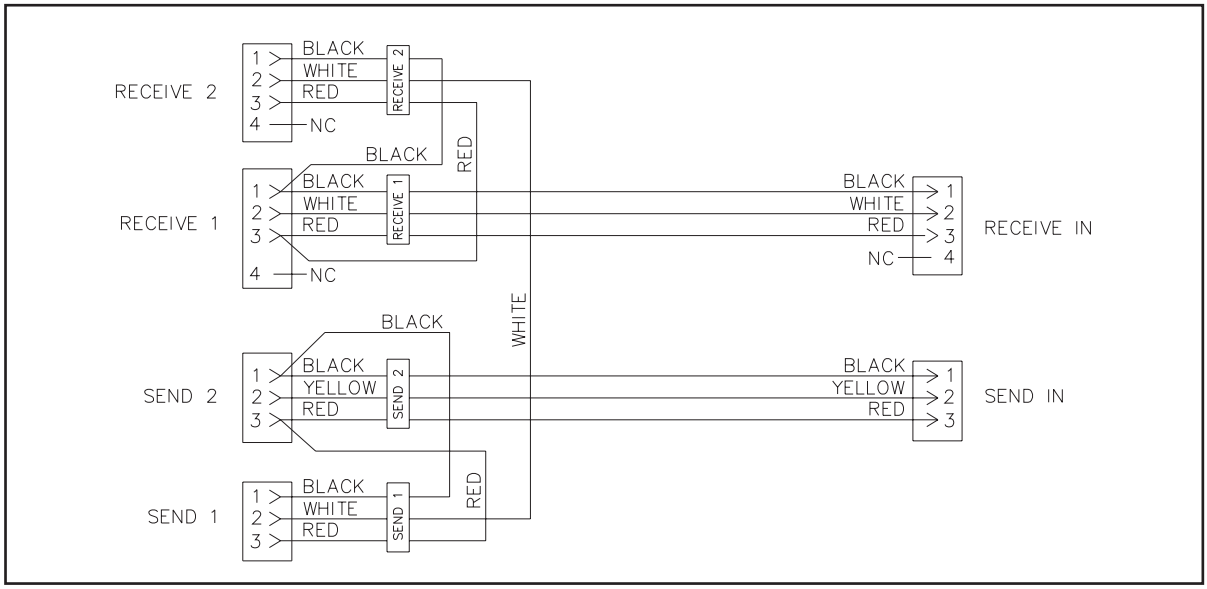
47-142881-000 - Masking Unit Interlock Cable



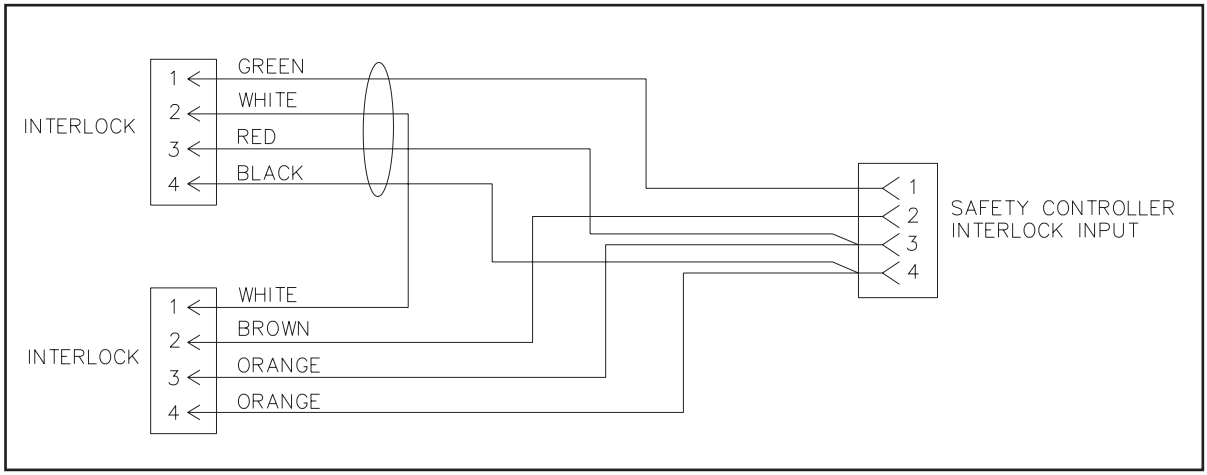
47-142865-000 - Photosensor Send Cable



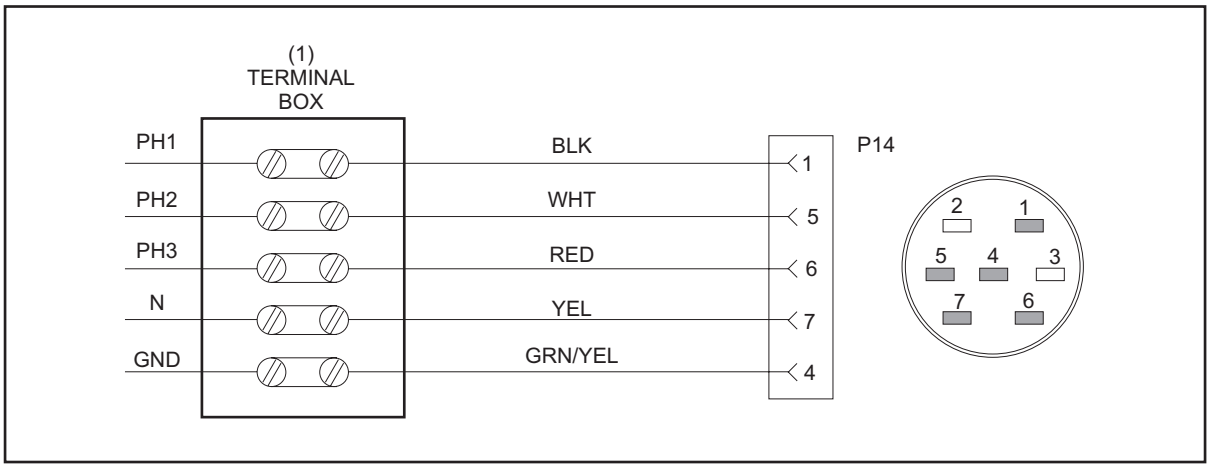
47-142874-000 - Photosensor Receive Cable



47-142875-000 - Photosensor Adapter Cable for Walkway with Obstruction

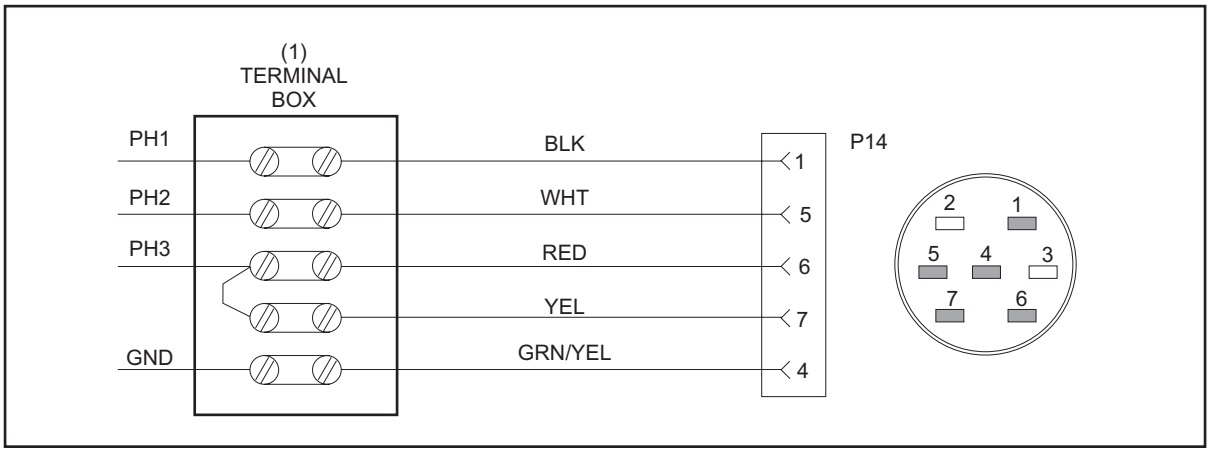


47-142878-000 - Interlock "Y" Cable for Odd and Separated Lane Pairs



AC-Power Input 380V x 400V

(1) TERMINAL BOX



AC-Power 3Ø x200V - 230V

(1) TERMINAL BOX

Contents

General Information 4-3

Cycles 4-7
- First Ball - Strike Cycle 4-9
- First Ball - Standing Pins Cycle 4-11
- First Ball - Short Cycle 4-13
- First Ball - Out-of-Range 4-15
- First Ball - Foul 4-17
- Second Ball - Single Detect 4-19
- Second Ball - Double Detect 4-21
- Second Ball - Out-of-Range 4-23

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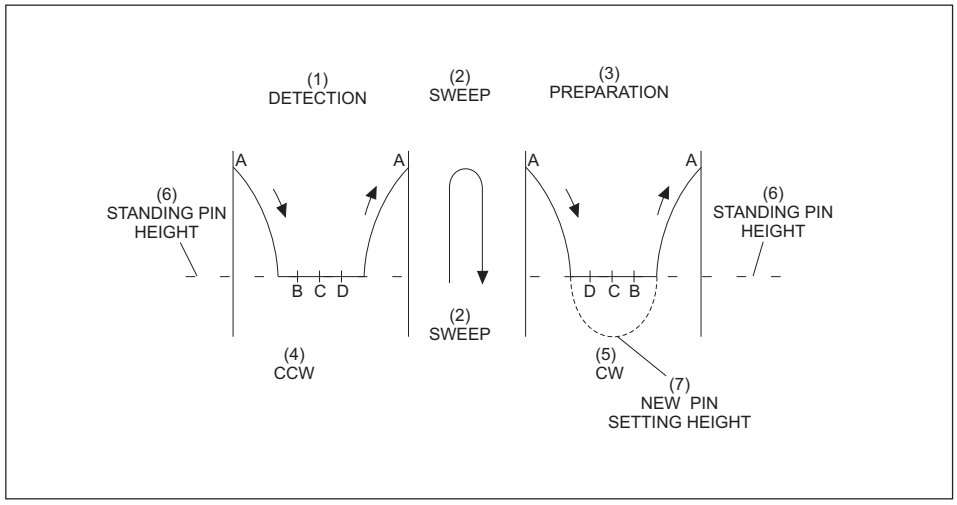
Section 4: Pinsetter Cycles

General Information

The GS-Series Pinsetter is capable of performing many different cycles in reaction to a bowler throwing a ball.

Every cycle can be divided into three segments. *Refer to Figure 4-1.* The first segment is the detection stroke. *Refer to Figure 4-2.* In this segment, the table is lowered to detect or find out the results of the ball hitting the pins. The sweep segment occurs after the detection stoke once the table returns to home position. During the sweep segment, deadwood is cleared from the pin deck and flat gutters. *Refer to Figure 4-3.* The final segment is the preparation stroke in which the pinsetter readies itself for the next ball. The table may lower for a short stroke if pins are respotted back onto the pin deck if they were lifted by the table during the detection segment or a long stroke if new pins are set on the pin deck in preparation for a new frame. *Refer to Figure 4-4.*



(1) DETECTION
(2) SWEEP
(3) PREPARATION
(4) COUNTERCLOCKWISE
(5) CLOCKWISE
(6) STANDING PIN HEIGHT
(7) NEW PIN SETTING HEIGHT

Figure 4-1. Cycle Segments

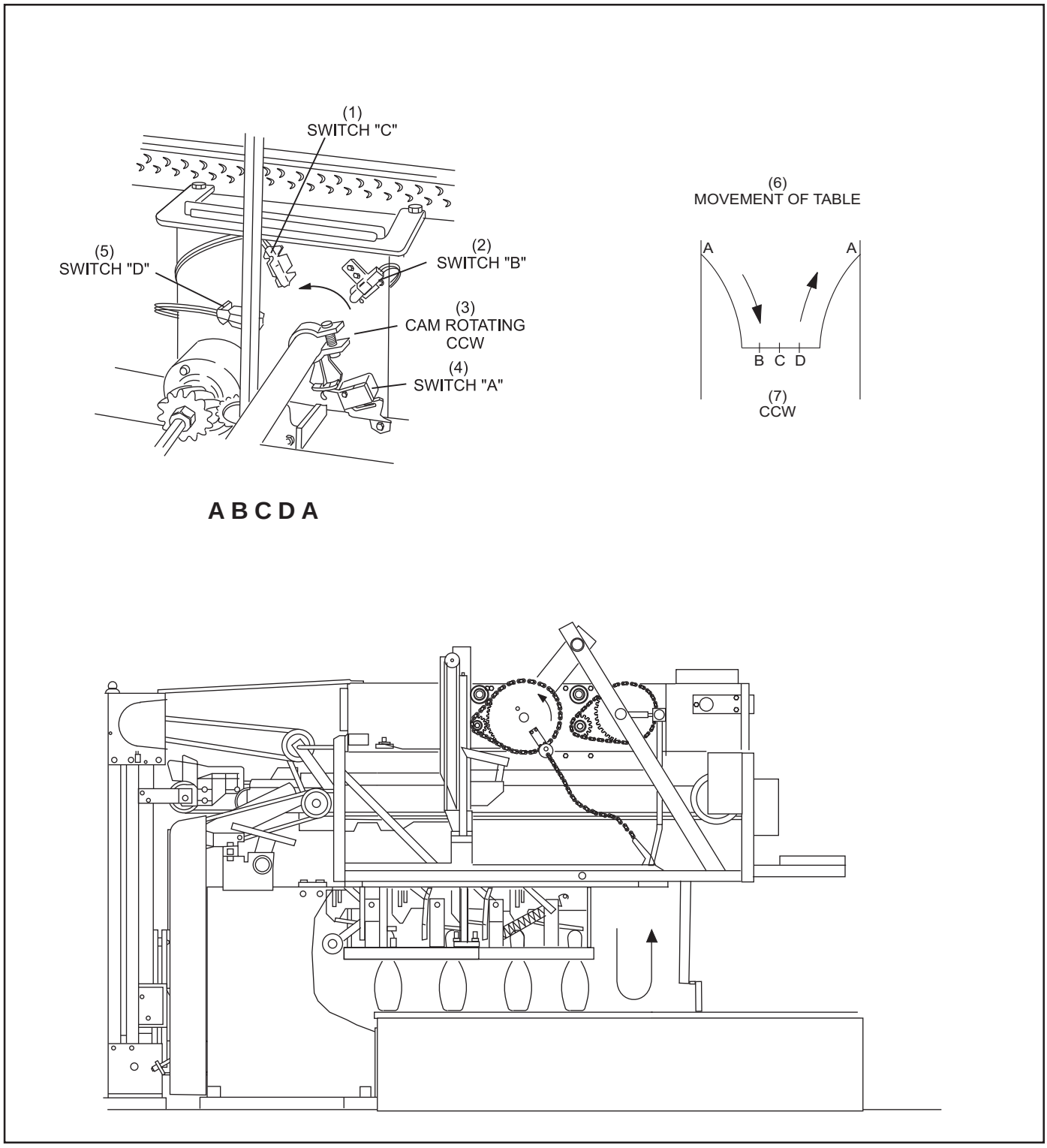


Figure 4-2. Detection Stroke

(1) SWITCH "C"
(2) SWITCH "B"
(3) CAM ROTATING COUNTER CLOCKWISE
(4) SWITCH "A"
(5) SWITCH "D"
(6) MOVEMENT OF TABLE
(7) COUNTERCLOCKWISE

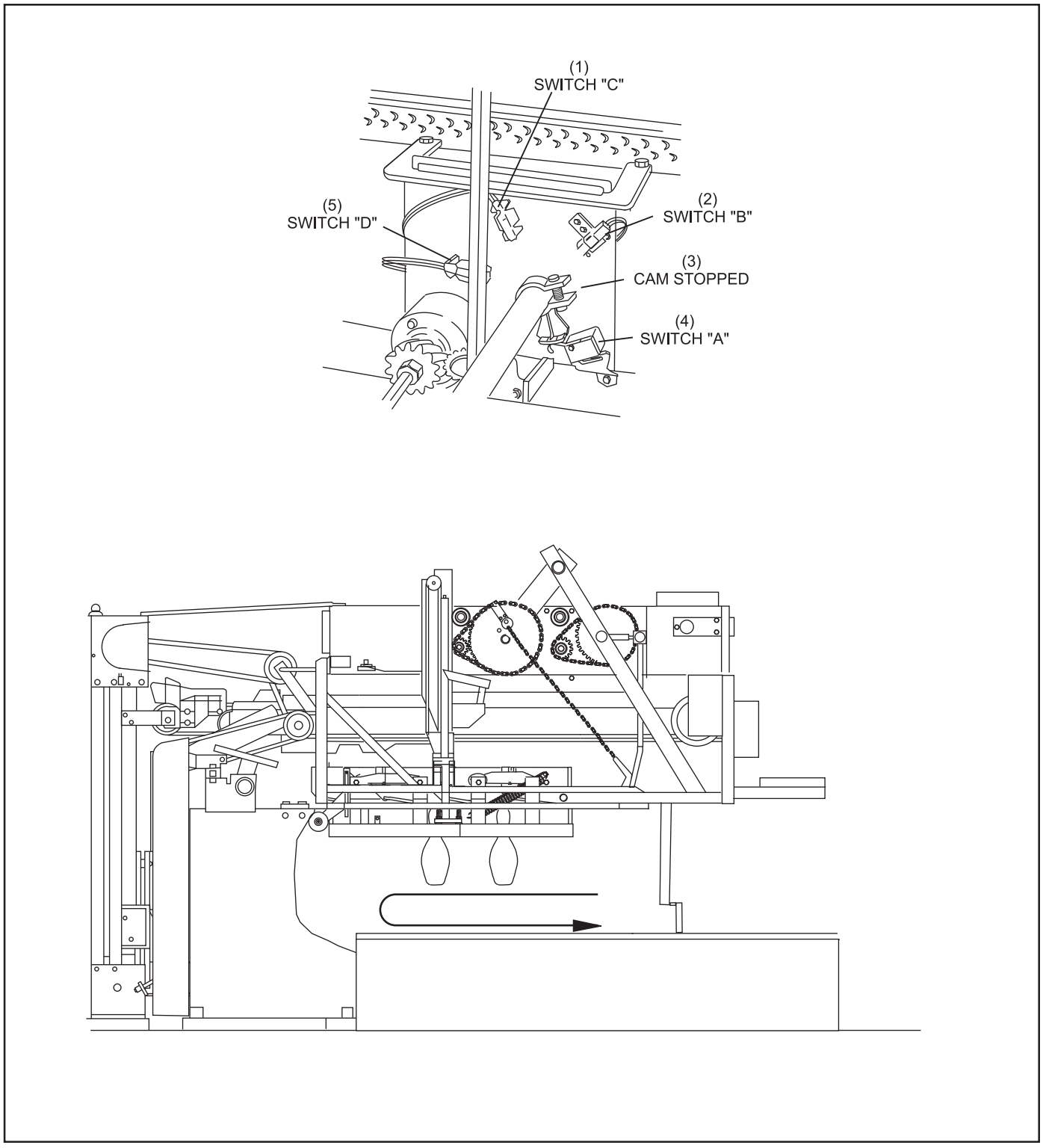


Figure 4-3. Sweeping Deadwood.

(1) SWITCH "C"
(2) SWITCH "B"
(3) CAM STOPPED
(4) SWITCH "A"
(5) SWITCH "D"

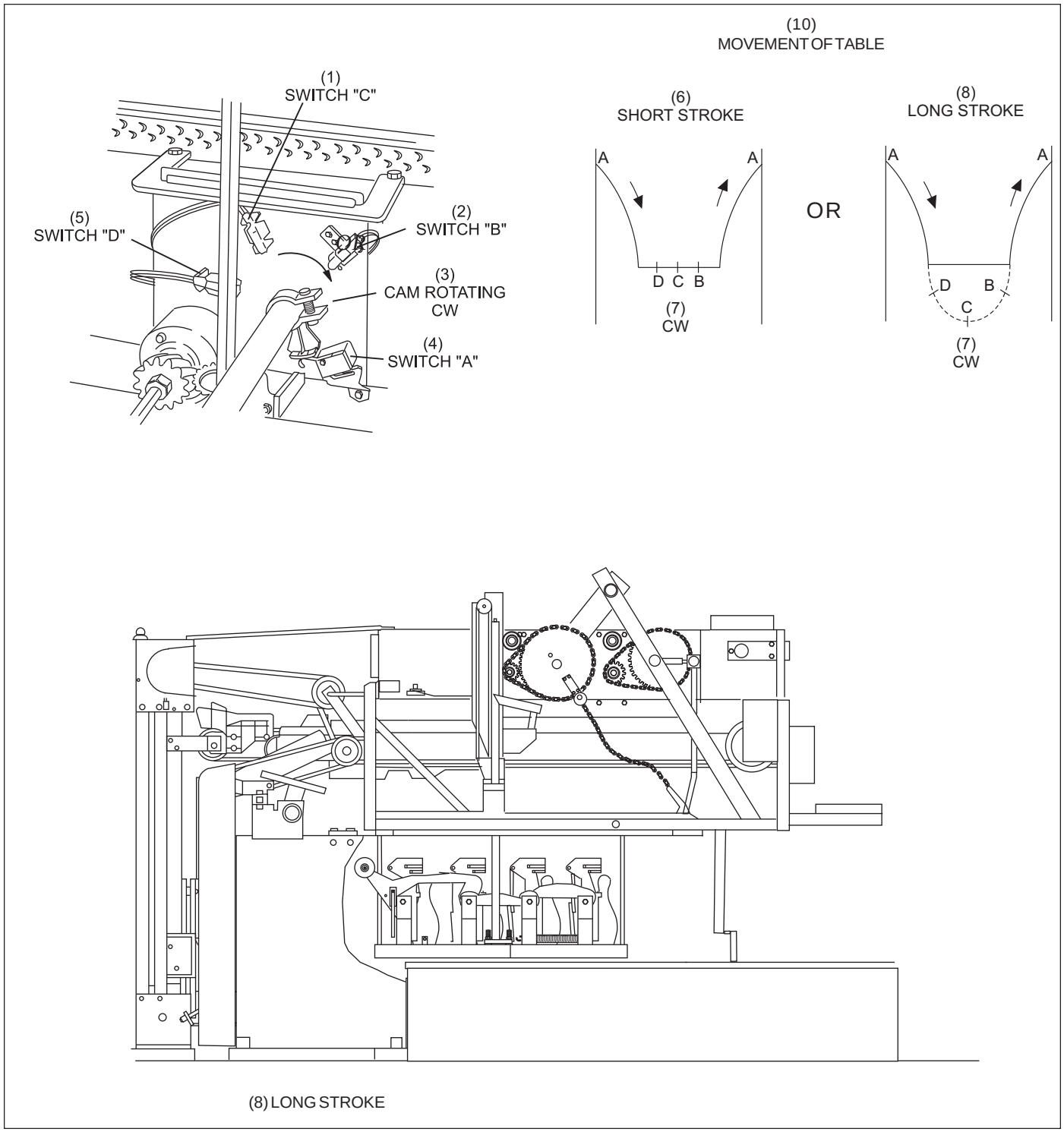


Figure 4-4. Preparation

(1) SWITCH "C"
(2) SWITCH "B"
(3) CAM ROTATING CLOCKWISE
(4) SWITCH "A"
(5) SWITCH "D"
(6) SHORT STROKE
(7) CLOCKWISE
(8) LONG STROKE
(9) SWITCH CLUSTER ROTATION
(10) MOVEMENT OF TABLE

Cycles

There are five first ball cycles and three second ball cycles. Additional cycles are available if a scoring system is connected to the pinsetters.

The first ball cycles are:

1. First Ball - Strike
2. First Ball - Standing Pins
3. First Ball - Short Cycle
4. First Ball - Out-Of-Range
5. First Ball - Foul

The second ball cycles are:

1. Second Ball - Single Detect
2. Second Ball - Double Detect
3. Second Ball - Out-Of-Range

Before the pinsetter can begin one of these cycles, The following events must occur: Refer to *Figure 4-5*

1. The pinsetter must be turned on, waiting for a ball.

2. The following conditions must be met:

    a. Table is up (“A” switch is closed)
    b. Sweep is forward (“SM” switch is closed)
    c. Sweep is up (“G” switch is not closed)
    d. Spotting tongs are fully open (“ST” switch is closed)

To begin a cycle a bowler must throw a ball. The pinsetter reacts as follows:

1. The ball detect “sees” a ball and sends a pulse to the Pinsetter CPU.

2. The ball door solenoid energizes to lock the ball door for 3-4 seconds. The sweep release solenoid energizes dropping the sweep.

3. Once sweep wagon lowers completely to the guarding position the “G” switch closes.

4. The table motor runs counterclockwise to start the cycle, causing the switch cluster cam to leave the A switch and rotate toward the “B” switch.

5. At the “B” switch the pinsetter will look at the foul unit input, OOR switch and the pinholder switches to determine what to do next.

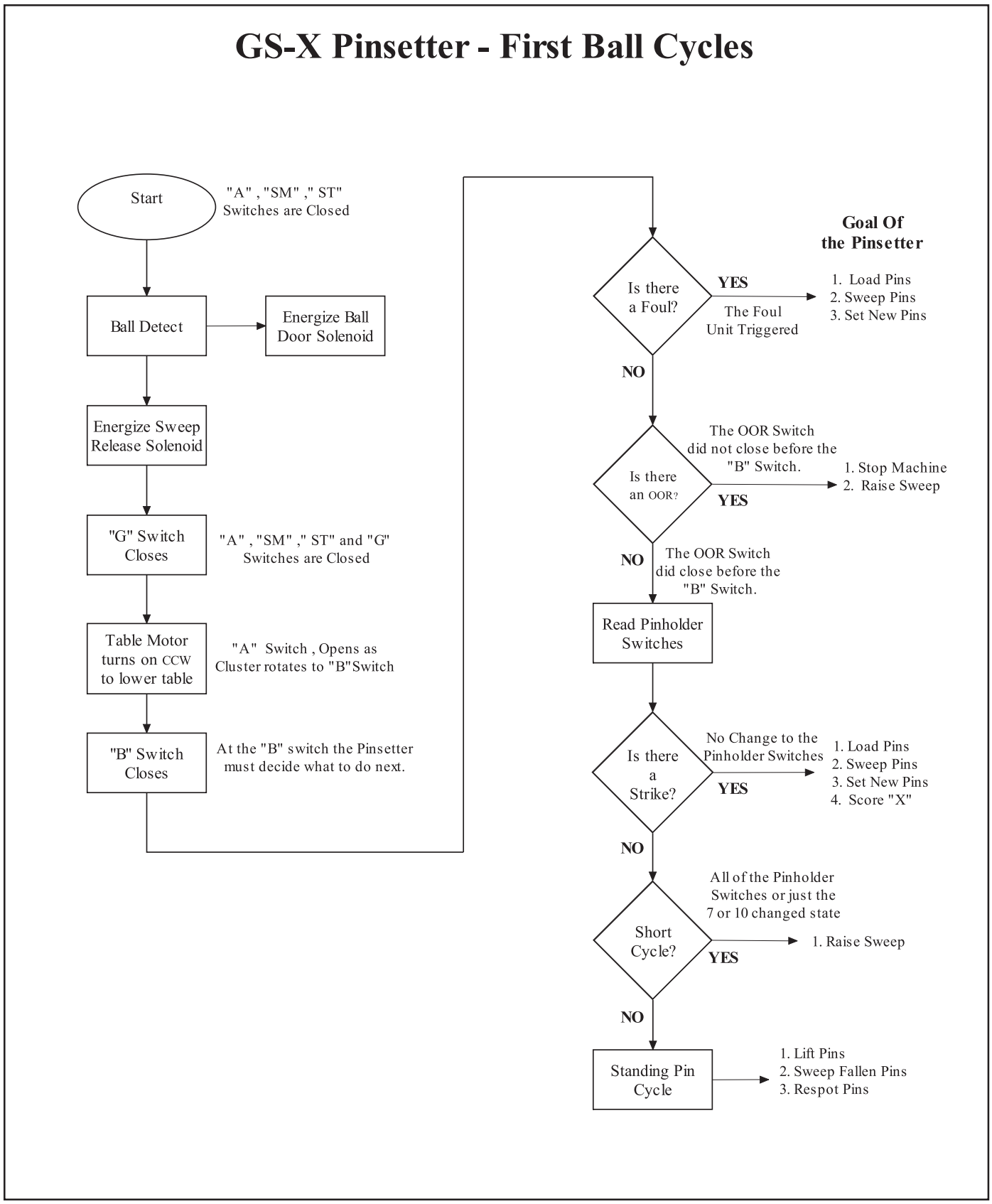

GS-X Pinsetter - First Ball Cycles
Start
"A" , "SM" ," ST" Switches are Closed
Ball Detect
Energize Ball Door Solenoid
Energize Sweep Release Solenoid
"G" Switch Closes
"A" , "SM" ," ST" and "G" Switches are Closed
Table Motor turns on CCW to lower table
"A" Switch , Opens as Cluster rotates to "B"Switch
"B" Switch Closes
At the "B" switch the Pinsetter must decide what to do next.
Goal Of the Pinsetter
Is there a Foul?
YES
The Foul Unit Triggered
1. Load Pins
2. Sweep Pins
3. Set New Pins
NO
Is there an OOR?
The OOR Switch did not close before the "B" Switch.
1. Stop Machine
2. Raise Sweep
YES
NO
The OOR Switch did close before the "B" Switch.
Read Pinholder Switches
Is there a Strike?
No Change to the Pinholder Switches
1. Load Pins
2. Sweep Pins
3. Set New Pins
4. Score "X"
YES
NO
Short Cycle?
All of the Pinholder Switches or just the 7 or 10 changed state
1. Raise Sweep
YES
NO
Standing Pin Cycle
1. Lift Pins
2. Sweep Fallen Pins
3. Respot Pins

Figure 4-5 Pinsetter Cycles

First Ball - Strike Cycle

A strike cycle results when a bowler is successful in knocking down all the pins with the first ball. The pinsetter will sweep any deadwood into the pit and set ten new pins onto the pin deck. The following is a complete description of this cycle. Refer to *Figure 4-6*.

1. A ball detect occurs.

2. In response to the ball detect signal the sweep release solenoid energizes to lower the sweep into the guard position actuating switch “G”. The ball door solenoid energizes, locking the ball door for three seconds.

3. The table motor runs counterclockwise. The cam on the table shaft will leave switch “A” moving toward switch “B”.

4. As the table lowers “OOR” switch closes to indicate the table entered the detection area.

5. The table will make a short stroke as it stops on the stroke limiter plate.

6. At switch “B”, the Pinsetter CPU reads the pin holder switches and determines that no pins were left standing. The Pinsetter CPU sends pinfall information (a strike) to the automatic scorer (if installed).

7. The cam passes switch “C” with no action.

8. As the cam actuates switch “D”, the pin holder solenoids energize to open the grippers.

9. As the table is lifted to its raised position, the open grippers push up on the pin release levers, causing pins to drop into the pin holders. Actuation of the pin holder switch by the pin causes the solenoid to de-energize, closing the gripper. Actuation of switch “A” caused the table motor to turn off.

10. The sweep motor turns on, pulling the sweep back then forward to clear the deadwood. When the sweep wagon is fully forward once again, switch “SM” closes causing sweep motor to turn off.

11. The table motor runs clockwise and the cam leaves the switch “A” and travels to switch “D.”

12. As the table starts to lower, the stroke limiter solenoid is energized causing the stroke limiter plate to be pulled away from the T-stop. This allows the table to go down to the pin deck, and releases the swing shafts on the table allowing the pin holders to go into the vertical pinsetting position.

13. The cam passes switch “D” and at switch “C” pin holder solenoids energize to open the grippers and leave the pins on the pin deck. At switch “B” the solenoids de-energize, closing the grippers.

14. As the table continues to rise, the pin holder solenoids for the 7 and 10 pins energizes to open the grippers to preload the 7 and 10 pins if they are in the pin station.

15. The table motor raises the table and the sweep until switch “A” is closed.

16. At “A” switch, the table motor turns off. The pinsetter is ready for a new first ball cycle.

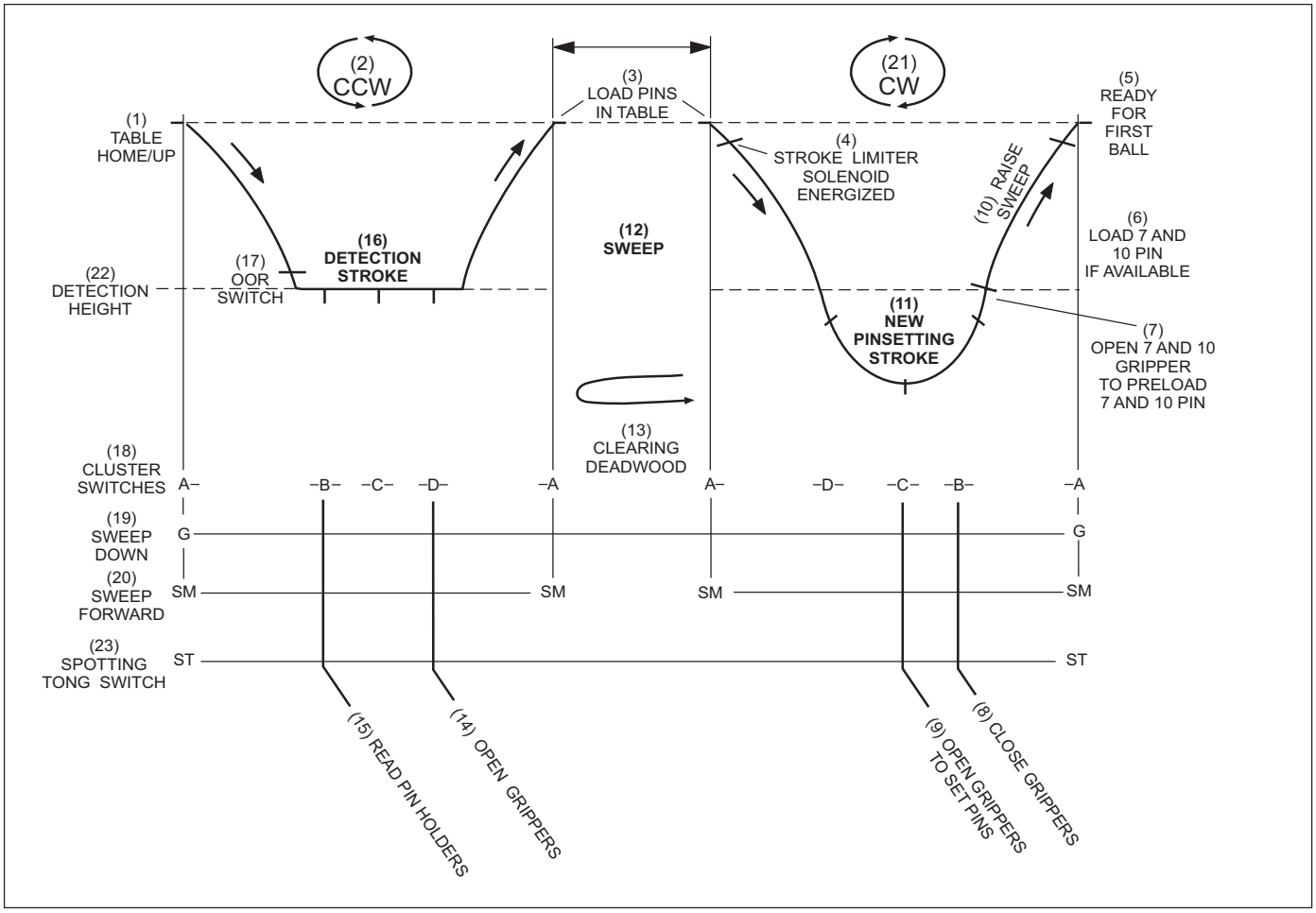

(2) CCW
(3) LOAD PINS IN TABLE
(21) CW
(5) READY FOR FIRST BALL
(1) TABLE HOME/UP
(4) STROKE LIMITER SOLENOID ENERGIZED
(10) RAISE SWEEP
(6) LOAD 7 AND 10 PIN IF AVAILABLE
(16) DETECTION STROKE
(12) SWEEP
(17) OOR SWITCH
(22) DETECTION HEIGHT
(11) NEW PINSETTING STROKE
(7) OPEN 7 AND 10 GRIPPER TO PRELOAD 7 AND 10 PIN
(13) CLEARING DEADWOOD
(18) CLUSTER SWITCHES
A– –B– –C– –D– –A A– –D– –C– –B– –A
(19) SWEEP DOWN
G G
(20) SWEEP FORWARD
SM SM SM SM
(23) SPOTTING TONG SWITCH
ST ST
(15) READ PIN HOLDERS
(14) OPEN GRIPPERS
(9) OPEN GRIPPERS TO SET PINS
(8) CLOSE GRIPPERS

Figure 4-6. First Ball Strike Cycle.

(1) TABLE HOME/UP
(2) COUNTERCLOCKWISE
(3) LOAD PINS IN TABLE
(4) STROKE LIMITER SOLENOID ENERGIZED
(5) READY FOR FIRST BALL
(6) LOAD 7 AND 10 PIN IF AVAILABLE
(7) OPEN 7 AND 10 GRIPPER TO PRELOAD
(8) CLOSE GRIPPERS
(9) OPEN GRIPPERS TO SET PINS 7 AND 10 PIN
(10) RAISE SWEEP
(11) NEW PINSETTING STROKE
(12) SWEEP
(13) CLEARING DEADWOOD
(14) OPEN GRIPPERS
(15) READ PIN HOLDERS
(16) DETECTION STROKE
(17) OUT-OF-RANGE SWITCH
(18) CLUSTER SWITCHES
(19) SWEEP DOWN
(20) SWEEP FORWARD
(21) CLOCKWISE
(22) DETECTION HEIGHT

First Ball - Standing Pins Cycle

This cycle results when the bowler knocks down up to nine pins. During this cycle the pinsetter lifts the pins left standing on the pin deck, the sweep clears the deadwood into the pit and the pins are set back down on the pin deck. The following is a description of this cycle. *Figure 4-7*.

1. A ball detect occurs.

2. In response to the ball detect signal the sweep release solenoid energizes to lower the sweep into the guard position actuating switch “G”. The ball door solenoid energizes, locking the ball door for three seconds.

3. The table motor runs counterclockwise. The cam on the table shaft will leave switch “A” moving toward switch “B”.

4. As the table lowers “OOR” switch closes to indicate the table entered the detection area.

5. The table will make a short stroke as it stops on the stroke limiter plate.

6. At switch “B” the Pinsetter CPU will read the pinholder switches and determine one or more pins are standing. The CPU sends the pinfall information to the automatic scorer (if installed).
   The spotting tong solenoid will energize and the tongs will be driven closed.

7. The cam passes switch “C” with no action.

8. As the cam actuates switch “D” the spotting tong solenoid is de-energized to stop the spotting tongs from closing further.

9. The table rises with the pins in the tongs. The table motor turns off when switch “A” is closed.

10. The sweep motor turns on, pulling the sweep back then forward to clear the deadwood. When the sweep wagon is fully forward once again, the “SM” switch closes causing the sweep motor to turned off.

11. The table motor runs clockwise and the cam leaves switch “A” and travels to switch “D”.

12. When switch “D” is closed, the spotting tong solenoid is energized. Because the table motor is now turning clockwise, the tongs will open leaving the pins on the pin deck.

13. The Cam passes switch “C” with no action.

14. At switch “B” the spotting tong solenoid de-energizes to stop the tong from opening further. The pin holder solenoids will energize to open the grippers allowing ten pins to be loaded when the table returns to home position.

15. The sweep release chain raises the sweep.

16. The table motor shuts off when switch ”A” is actuated.

17. The pinsetter is ready for a second ball cycle.

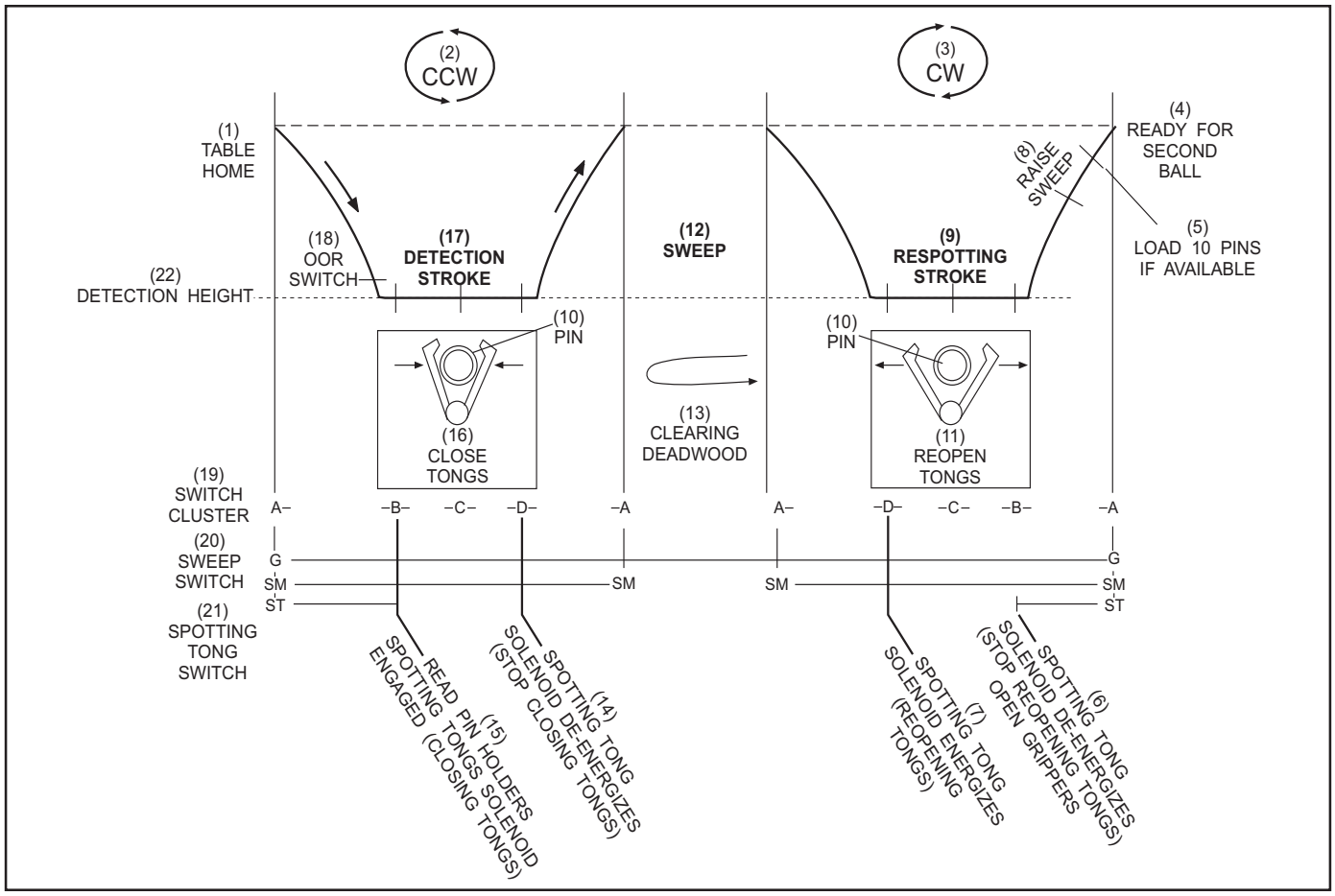


Figure 4-7. First Ball Standing Pins Cycle.

(1) TABLE HOME
(2) COUNTERCLOCKWISE
(3) CLOCKWISE
(4) READY FOR SECOND BALL
(5) LOAD 10 PINS IF AVAILABLE
(6) SPOTTING TONG SOLENOID DE-ENERGIZES (STOP REOPENING TONGS) OPEN GRIPPERS
(7) SPOTTING TONG SOLENOID ENERGIZES (REOPENING TONGS)
(8) RAISE SWEEP
(9) RESPOTTING STROKE
(10) PIN
(11) REOPEN TONGS
(12) SWEEP
(13) CLEARING DEADWOOD
(14) SPOTTING TONG SOLENOID DE-ENERGIZES (STOP CLOSING TONGS)
(15) READ PIN HOLDERS SPOTTING TONG SOLENOID ENGAGED (CLOSING TONGS)
(16) CLOSE TONGS
(17) DETECTION STROKE
(18) OUT-OF-RANGE SWITCH
(19) SWITCH CLUSTER
(20) SWEEP SWITCH
(21) SPOTTING TONG SWITCH
(22) DETECTION HEIGHT

First Ball - Short Cycle

A short cycle occurs in the following situations after rolling the first ball.

A. The 7 pin was the only pin knocked down by a ball.
B. The 10 pin was the only pin knocked down by a ball.
C. No pins were knocked down by a ball (gutter ball).

If one of these conditions occurs, the Pinsetter CPU determines that there is no deadwood and the sweep operation is not necessary. The table lowers on top of the pins and then returns to the home position. Decreasing the length of time necessary to complete the first ball cycle. Refer to *Figure 4-8.*

1. A ball detect occurs.

2. The sweep release solenoid energizes to lower the sweep into the guard position actuating the "G" switch. The ball door solenoid energizes locking the ball door for three seconds.

3. The table motor runs counterclockwise to allow the table to lower. The cam on the table shaft will leave switch "A."

4. The table racks will lower and pulse (close) the "OOR" switch indicating the table entered the detection area.

5. The table will make a short stroke as it stops on the stroke limiter plate.

6. At the "B" switch, the Pinsetter CPU will read the pin holder switches and find one of the three conditions listed above. It also sends the pinfall information to the automatic scorer.

7. The table motor will stop briefly when the "C" switch is closed. Then reverse direction (CW).

8. The pin holder solenoids energize to open the grippers at switch "B" to allow pins to be loaded when the table returns to the home position.

9. The sweep release chain raises the sweep.

10. The table motor shuts off when "A" switch is actuated.

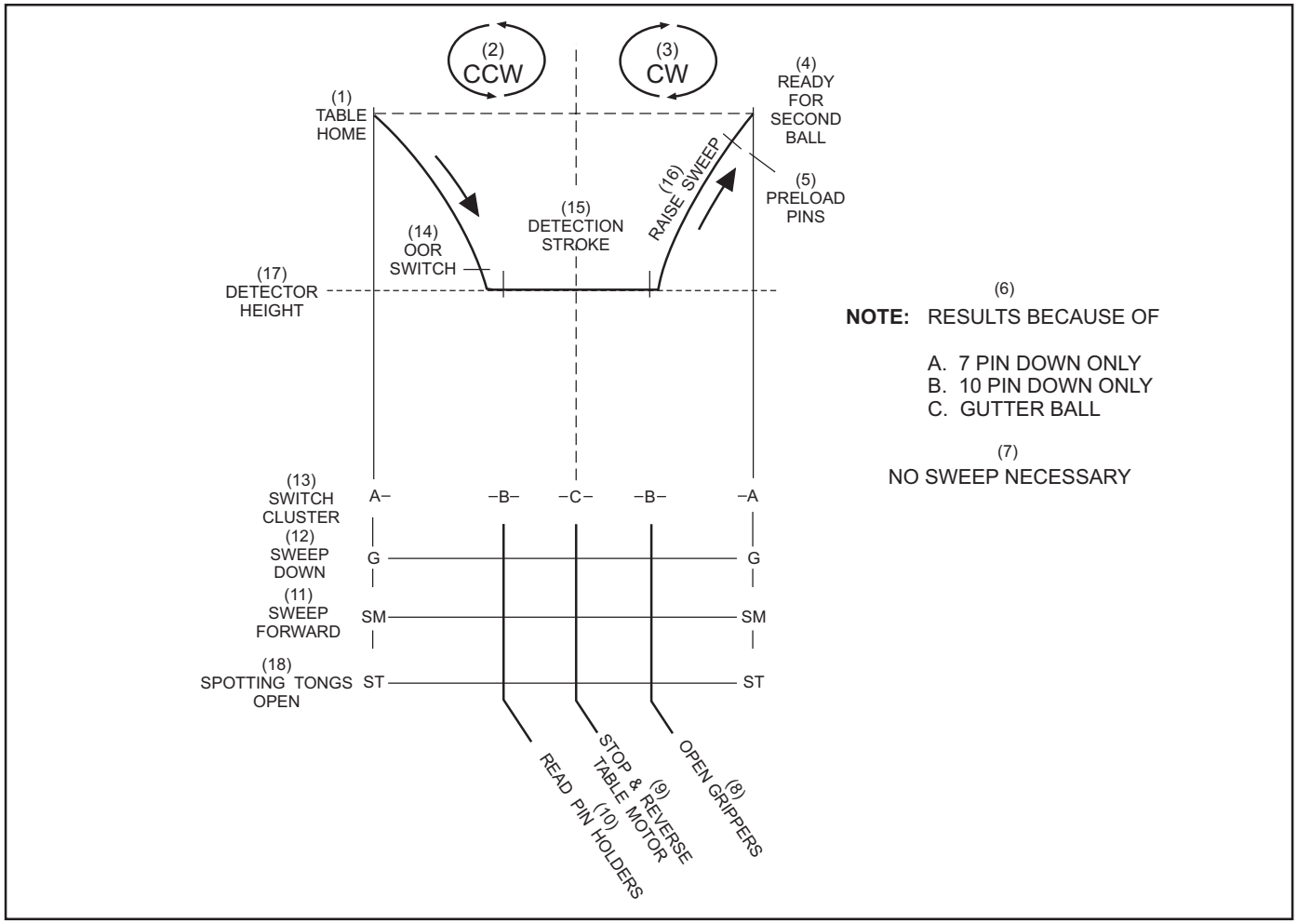


Figure 4-8. First Ball Short Cycle.

(1) TABLE HOME
(2) COUNTERCLOCKWISE
(3) CLOCKWISE
(4) READY FOR SECOND BALL
(5) PRELOAD PINS
(6) NOTE: RESULTS BECAUSE OF
A. 7 PIN DOWN ONLY
B. 10 PIN DOWN ONLY
C. GUTTER BALL
(7) NO SWEEP NECESSARY
(8) OPEN GRIPPERS
(9) STOP AND REVERSE TABLE MOTOR
(10) READ PIN HOLDERS
(11) SWEEP FORWARD
(12) SWEEP DOWN
(13) SWITCH CLUSTER
(14) OUT-OF-RANGE SWITCH
(15) DETECTION STROKE
(16) RAISE SWEEP
(17) DETECTOR HEIGHT
(18) SPOTTING TONG OPEN

First Ball - Out-of-Range

During the course of bowling, a ball may strike the pins in such a way that a pin slides out of its normal position but does not fall down. If the pin moves far enough, the bottom of the table will lower on top of the pin. This will keep the table from lowering to the normal detection height and prevent it from detecting the standing pins and thus scoring or picking them up. Bowling Association rules (such as ABC and FIQ) require that any deadwood left on the lane surface be removed before the bowler rolls a second ball. To accomplish this, the Pinsetter CPU will stop the pinsetter after the detection portion of the cycle and signal for the mechanic/technician to remove any deadwood and to restart the pinsetter. Refer to *Figure 4-9.* The cycle occurs as follows:

1. A ball detect occurs.

2. In response to the ball detect signal the sweep release solenoid energizes to lower the sweep into the guard position actuating switch “G”. The ball door solenoid energizes, locking the ball door for three seconds.

3. The table motor runs counterclockwise. The cam on the table shaft will leave switch “A” moving toward switch “B”.

4. The table lowers on top of the off spot pin stopping the table before it can close the “OOR” switch.

5. At switch “B” the Pinsetter CPU will ignore the pin holder switches, because the “OOR” switch had not been actuated. The pinfall will have to be entered manually if scorers are present.

6. The table motor continues to turn the cam past switches “C” and “D” switches until switch “A” is closed.

7. The pinsetter will shut off at “A” switch with the sweep still down in the guarding position. The trouble light will flash and the LED will display the error code “PO” or “Pin OOR”.

8. To clear the error, the mechanic must turn the stop/run switch on the Nexgen box or mechanic’s rear control box “OFF”. Deadwood can then be cleared from the pin deck.

9. The mechanic must then turn the pinsetter back on to allow the pinsetter to resume operation. (If Frameworx, Classic or Vector scoring is involved, a score correction must be made at the scorer console before the pinsetter can restart).

10. To prevent the standing pins from being swept, the sweep motor will not be allowed to run.

11. The table motor rotates the cam clockwise past switches “D”, “C”, “B” until it returns to “A.” The reason for this is to raise the sweep from its guarding position.

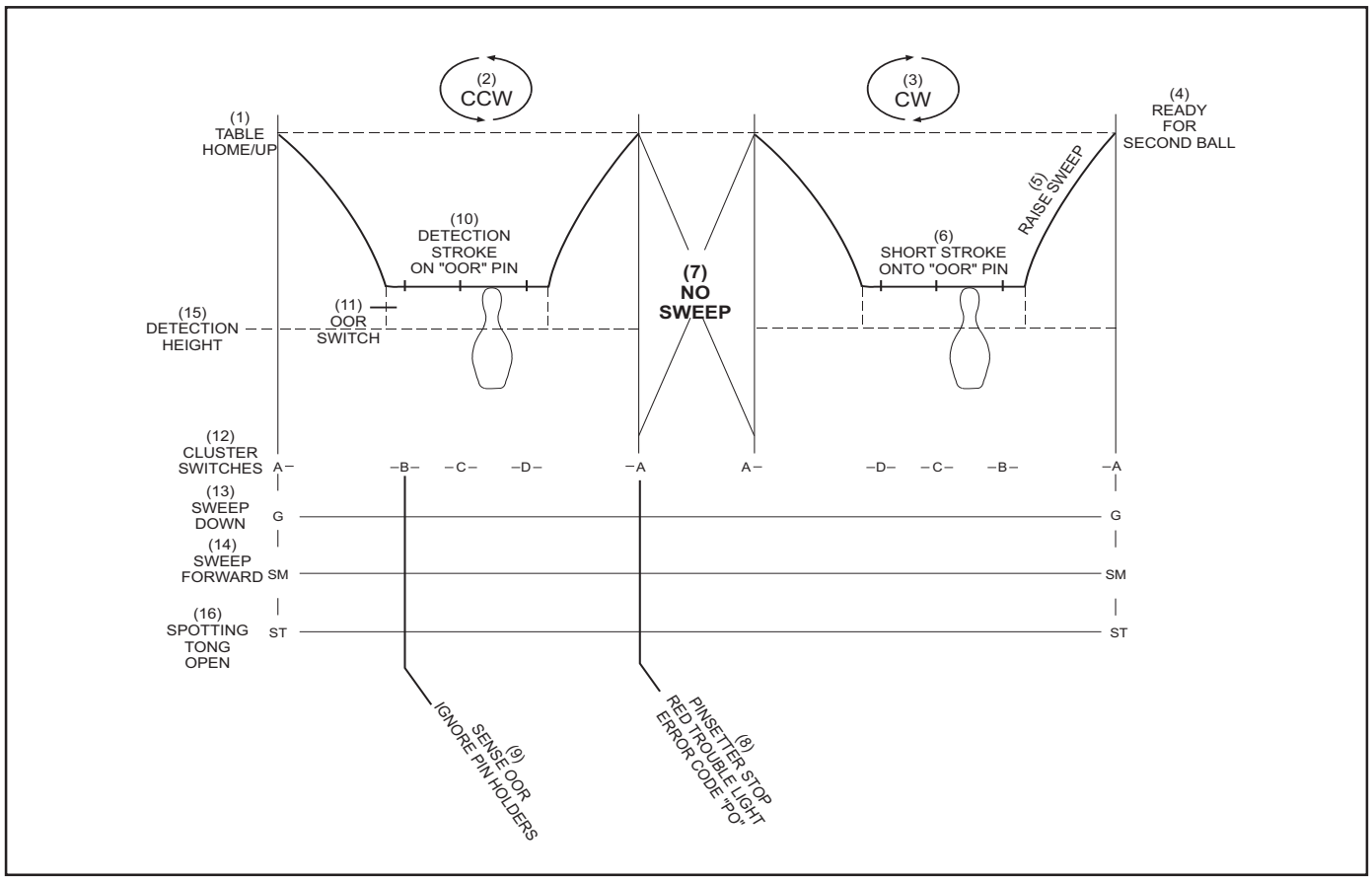


Figure 4-9. First Ball Out-Of-Range Cycle.

(1) TABLE HOME/UP
(2) COUNTERCLOCKWISE
(3) CLOCKWISE
(4) READY FOR SECOND BALL
(5) RAISE SWEEP
(6) SHORT STROKE ONTO OUT-OF-RANGE PIN
(7) NO SWEEP
(8) PINSETTER STOP RED TROUBLE LIGHT ERROR CODE “PO”
(9) SENSE OUT-OF-RANGE IGNORE PIN HOLDERS
(10) DETECTION STROKE ON OUT-OF-RANGE PIN
(11) OUT-OF-RANGE SWITCH
(12) CLUSTER SWITCHES
(13) SWEEP DOWN
(14) SWEEP FORWARD
(15) DETECTION HEIGHT
(16) SPOTTING TONG OPEN

First Ball - Foul

When a bowler steps on the foul line, a beam of light over the foul line is interrupted. A signal is then sent to the Pinsetter CPU. The pinsetter must sweep all pins and set ten new pins. The bowler receives zero pins for the first ball and has only one chance to knock down the new pins. Refer to *Figure 4-10.*

1. A foul signal is sent to the Pinsetter CPU.

2. A ball detect occurs.

3. In response to the ball detect signal the sweep release solenoid energizes to lower the sweep into the guard position actuating switch “G”. The ball door solenoid energizes, locking the ball door for three seconds.

4. The table motor runs counterclockwise. The cam on the table shaft will leave switch “A” moving toward switch “B”.

5. As the table lowers “OOR” switch closes to indicate the table entered the detection area.

6. The table will make a short stroke as it stops on the stroke limiter plate.

7. At switch “B”, the Pinsetter CPU will ignore the pin holder switches. A foul signal will be sent to the automatic scorer (if installed) instead of the actual pinfall.

8. The cam passes switch “C” with no action.

9. As the cam actuates switch “D”, the pin holder solenoids for all 10 pins energize to open the grippers.

10. As the table returns to its home position the open grippers push up on pin release levers, dropping the pins into the pin holders. Once the pin holder’s switch has been closed, the solenoid de-energized closing the gripper at switch “A” the table motor shuts off.

11. The sweep motor turns on, pulling the sweep back then forward to clear the pin deck. When the sweep wagon is fully forward once again, switch “SM” closes causing the sweep motor to be turned off.

12. The table motor runs clockwise rotating the cam from switch “A” to switch “D.”

13. As the table starts to lower, the stroke limiter solenoid energizes causing the stroke limiter plate to be pulled away from the tables T-Stop. This allows the table to go down to the new pinsetting height and releases the swing shafts on the table allowing the pin holders to go into the vertical pinsetting position.

14. The cam passes switch “D” and at switch “C” the pin holder solenoids energize to open the grippers leaving the pins on the pin deck. At switch “B” the solenoids de-energize closing the grippers.

15. As table continues to rise, the pin holder solenoids for all ten pins energizes to open the grippers; preloading pins if they are available in the pin station.

16. The table motor raises the table and the sweep until switch “A” is closed.

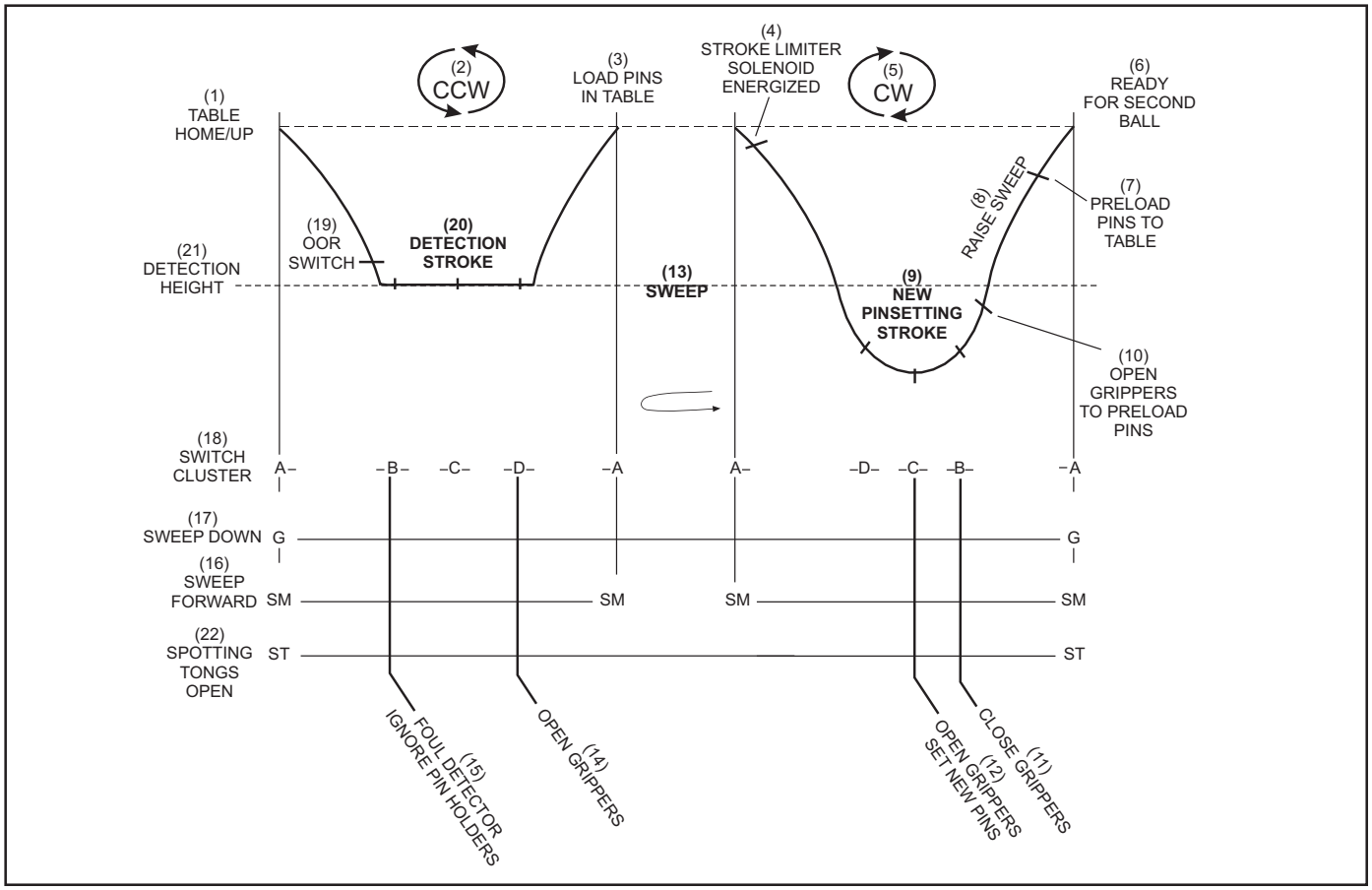


Figure 4-10. First Ball Foul Cycle.

(1) TABLE HOME/UP
(2) COUNTERCLOCKWISE
(3) LOAD PINS IN TABLE
(4) STROKE LIMITER SOLENOID ENERGIZED
(5) CLOCKWISE
(6) READY FOR SECOND BALL
(7) PRELOAD PINS TO TABLE
(8) RAISE SWEEP
(9) NEW PINSETTING STROKE
(10) OPEN GRIPPERS TO PRELOAD PINS
(11) CLOSE GRIPPERS
(12) OPEN GRIPPERS SET NEW PINS
(13) SWEEP
(14) OPEN GRIPPERS
(15) FOUL DETECTOR IGNORE PIN HOLDERS
(16) SWEEP FORWARD
(17) SWEEP DOWN
(18) SWITCH CLUSTER
(19) OUT-OF-RANGE SWITCH
(20) DETECTION STROKE
(21) DETECTION HEIGHT
(22) SPOTTING TONGS OPEN

Second Ball - Single Detect

Second ball - single detect is a second ball cycle used when the pinsetter is not used to provide scorer information to an automatic scorer. This cycle would be used when automatic scorers are not present or when an external device is used to provide pinfall to the automatic scoring system. Refer to *Figure 4-11*.

During this cycle the table does not lower to detect the pins' it simply sweeps away any pins left on the pin deck and sets ten new pins in preparation for a first ball cycle.

1. The ball detect occurs.

2. In response to the ball detect signal the sweep release solenoid energizes to lower the sweep into the guard position actuating switch "G". The ball door solenoid energizes, locking the ball door for three seconds.

3. The sweep motor turns on pulling the sweep back then forward to clear the pin deck. When the sweep wagon is fully forward, switch "SM" closes and the sweep motor is turned off.

4. When all ten pin holders are loaded with pins, the table motor runs clockwise rotating the cam from switch "A" to switch "D."

5. As the table starts to lower, the stroke limiter solenoid is energized causing the stroke limiter plate to be pulled away from the T-stop. This allows the table to go down to the pin deck, and releases the swing shafts on the table allowing the pin holders to go into the vertical pinsetting position.

6. The cam passes switch "D" and at switch "C" the pin holder solenoids energize to open the grippers leaving the pins on the pin deck. At switch "B" the solenoids de-energize closing the grippers.

7. As the table continues to rise, the 7 and 10 pin holder solenoids energize to preload the 7 and 10 pins if the pins are in the pin station.

8. The table motor raises the table and the sweep until switch "A" is closed.

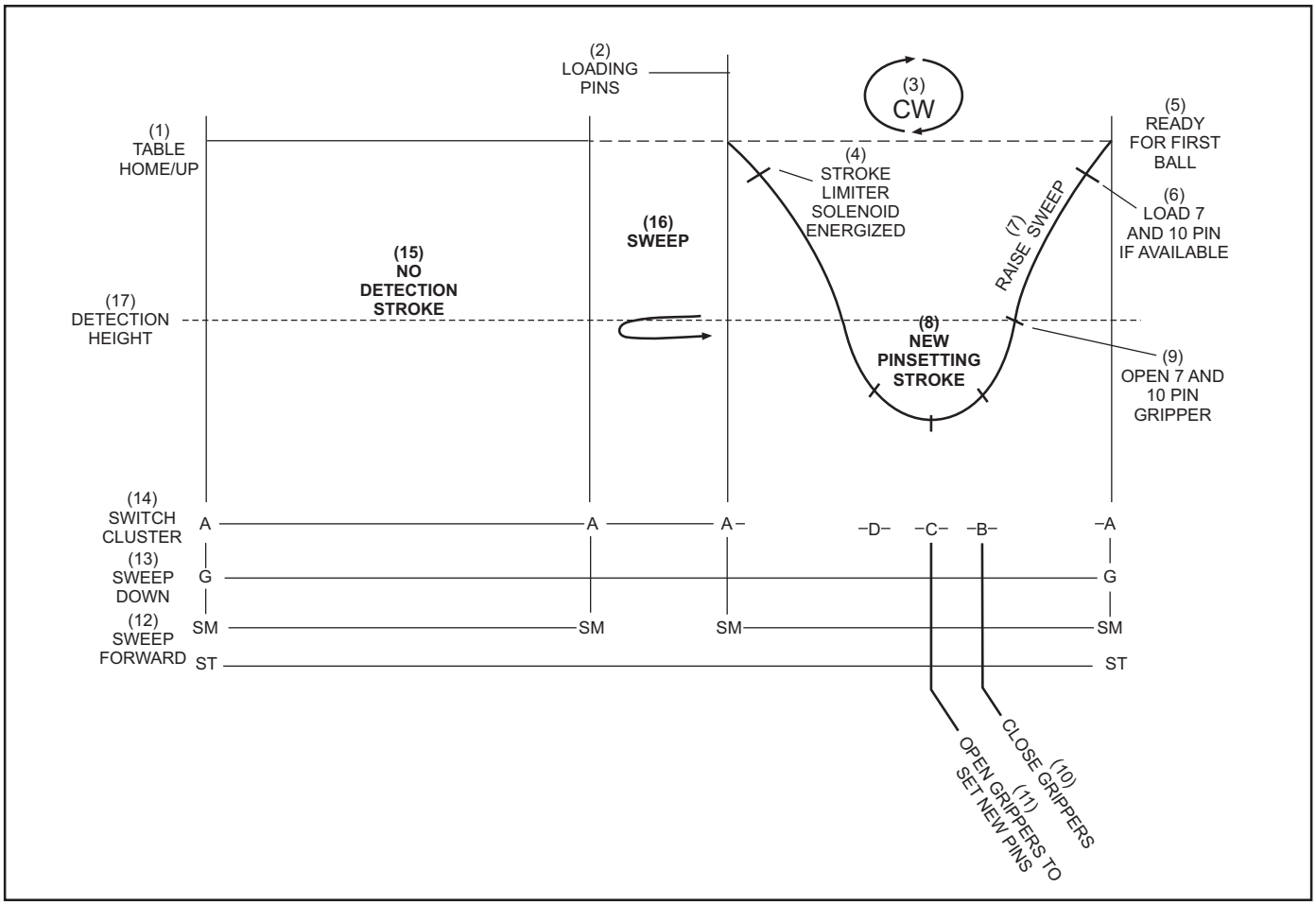


Figure 4-11. Second Ball Single Detect Cycle.

(1) TABLE HOME/UP
(2) LOADING PINS
(3) CLOCKWISE
(4) STROKE LIMITER SOLENOID ENERGIZED
(5) READY FOR FIRST BALL
(6) LOAD 7 AND 10 PIN IF AVAILABLE
(7) RAISE SWEEP
(8) NEW PINSETTING STROKE
(9) OPEN 7 AND 10 PIN GRIPPER
(10) CLOSE GRIPPERS
(11) OPEN GRIPPERS SET NEW PINS
(12) SWEEP FORWARD
(13) SWEEP DOWN
(14) SWITCH CLUSTER
(15) NO DETECTION STROKE
(16) SWEEP

Second Ball - Double Detect

This cycle is used when the GS-Series Pinsetter must provide scoring for Brunswick , Frameworx, AS-90 and AS-K, or Classic automatic scoring systems. The term Double Detect simply means that the table will lower to detect pins on both 1st and 2nd ball cycles. Refer to *Figure 4-12.*

1. A ball detect occurs.

2. In response to the ball detect signal the sweep release solenoid energizes to lower the sweep into the guard position actuating switch “G” The ball door solenoid energizes, locking the ball door for three seconds.

3. The table motor runs counterclockwise. The cam on the table shaft will leave switch “A” moving toward switch “B”.

4. As table lowers the “OOR” switch closes to indicate the table entered the detection area.

5. The table will make a short stroke as it stops on the stroke limiter plate.

6. At switch “B”, the Pinsetter CPU will read the pin holder switches. The Pinsetter CPU sends pinfall information to the automatic scorer.

7. The cam passes switch “C” with no action.

8. As the cam actuates switch “D”, the pin holder solenoids energize to open the grippers.

9. As the table is lifted to its raised position, the open grippers push up on the pin release levers, causing pins to drop into the pin holders. Actuation of the pin holder switch by the pin causes the solenoid to de-energize, closing the gripper. Actuation of switch “A” caused the table motor to turn off.

10. The sweep motor turns on, pulling the sweep back then forward to clear the deadwood. When the sweep wagon is fully forward once again, switch “SM” closes causing sweep motor to turn off.

11. The table motor runs clockwise and the cam leaves switch “A” and travels to switch “D.”

12. As the table starts to lower, the stroke limiter solenoid is energized causing the stroke limiter plate to be pulled away from the T-stop. This allows the table to go down to the pin deck, and releases the swing shafts on the table allowing the pin holders to go into the vertical pinsetting position.

13. The cam passes switch “D” and at switch “C” pin holder solenoids energize to open the grippers and leave the pins on the pin deck. At switch “B” the solenoids de-energize, closing the grippers.

14. As the table continues to rise, the pin holder solenoids for the 7 and 10 pins energizes to open the grippers to preload the 7 and 10 pins if they are in the pin station.

15. The table motor raises the table and the sweep until switch “A” is closed.

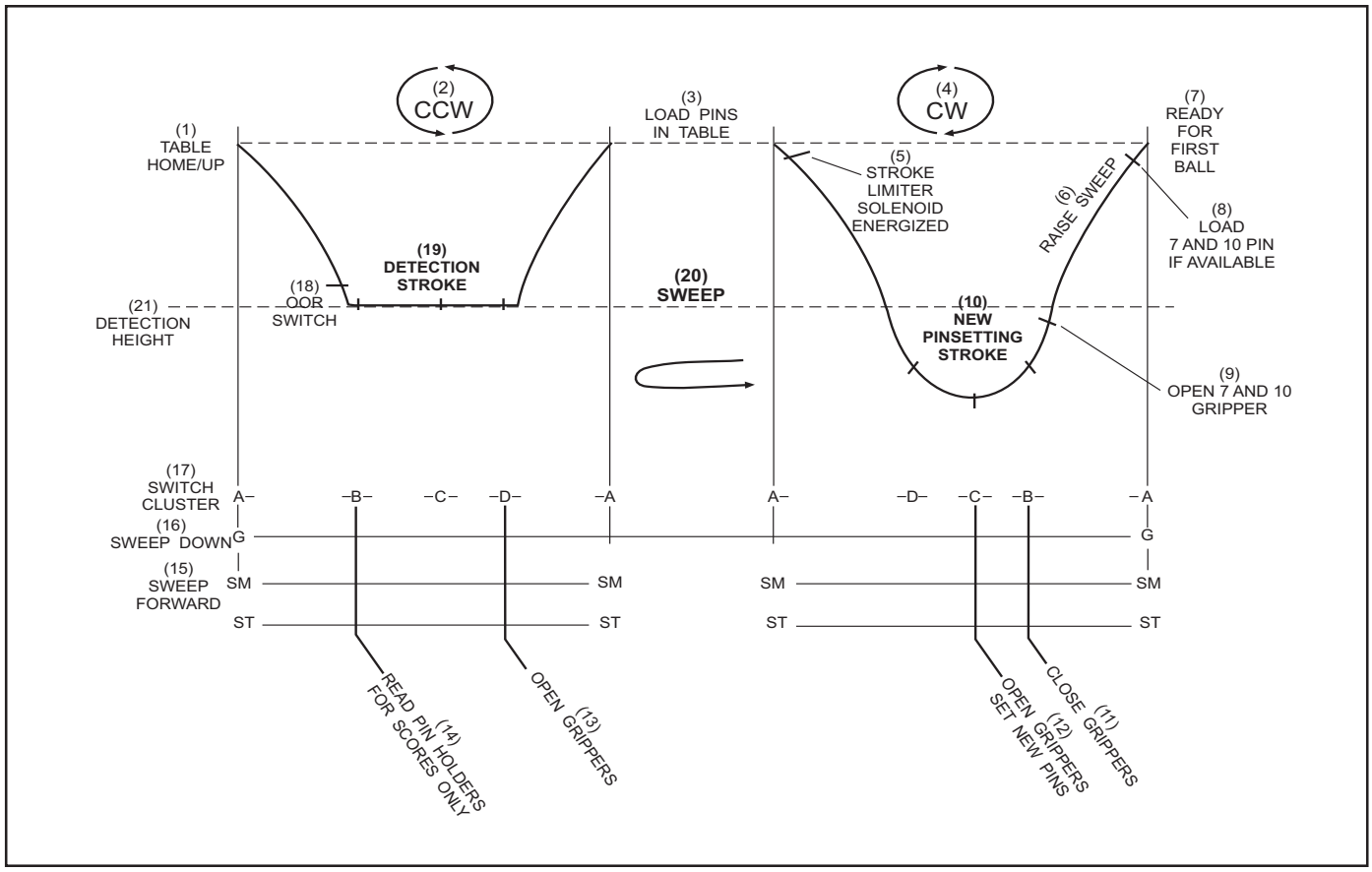


Figure 4-12. Second Ball Double Detect Cycle.

(1) TABLE HOME/UP	(2) COUNTERCLOCKWISE	(3) LOAD PINS IN TABLE
(4) CLOCKWISE	(5) STROKE LIMITER SOLENOID ENERGIZED	(6) RAISE SWEEP
(7) READY FOR FIRST BALL	(8) LOAD 7 AND 10 PIN IF AVAILABLE	(9) OPEN 7 AND 10 GRIPPER
(10) NEW PINSETTING STROKE	(11) CLOSE GRIPPERS	(12) OPEN GRIPPERS SET NEW PINS
(13) OPEN GRIPPERS	(14) READ PIN HOLDERS FOR SCORES ONLY	(15) SWEEP FORWARD
(16) SWEEP DOWN	(17) SWITCH CLUSTER	(18) OUT-OF-RANGE SWITCH
(19) DETECTION STROKE	(20) SWEEP	(21) DETECTION HEIGHT

Second Ball - Out-of-Range

A second ball out-of-range occurs only when the Pinsetter CPU is set up for double detection. The table will come down on top of an off spot pin as happens in a first ball out-of-range. This causes the pinsetter to stop and requires the mechanic to restart the pinsetter. Refer to *Figure 4-13.*

1. A ball detect occurs.

2. The sweep release solenoid energizes to lower the sweep into the guard position activate the "G" switch. The ball door solenoid energizes locking the ball door for three seconds.

3. The table motor runs counterclockwise to allow the table to lower. The cam on the table shaft leaves switch "A" and goes toward switch "B."

4. The table lowers on top of the off spot pin stopping the table before it can close the "OOR" switch.

5. At the "B" switch the Pinsetter CPU will ignore the pin holder switches, because the "OOR" switch had not been actuated. The pinfall will have to be entered manually if scorers are present.

6. The table motor continues to turn the cam past the "C" and "D" switches until the "A" switch is closed.

7. The pinsetter will shut off at "A" switch with the sweep still down in the guarding position. The trouble light will flash and the LED will display the error code "PO" or "Pin OOR".

8. To clear the error, the mechanic must turn the stop/run switch on the Nexgen box or mechanic's rear control box off. It is not necessary to clear deadwood from the pin deck.

9. The mechanic must then turn the pinsetter back on to allow the pinsetter to resume operation. (If Frameworx, Classic, or Vector scoring is involved, a score correction must be made at the scorer console before the pinsetter can restart).

10. If pins need to be loaded into the pinholders, the table motor rotates the cam clockwise past switches "D", "C", "B" until it returns to "A" to create a load opportunity. If ten pins are already loaded into the pinholders the pinsetter will run the sweep (Step 14).

11. The Pinsetter CPU immediately energizes the sweep release solenoid to drop the sweep wagon into the guarding position again, actuating switch "G"

12. Motor turns counterclockwise rotating the switch cam from “A” to “B” to “C” to “D”. At switch “D” the pinholder solenoids energize to open the grippers.

13. Pins are loaded into the pinholders from the pin stations as the table returns to its home position (switch “A”). The table motor turns off at switch “A”.

14. The sweep motor turns on, pulling the sweep back then forward to clear the pin deck. When the sweep wagon is fully forward the “SM” switch closes and the sweep motor is turned off.

15. When all pin holders are loaded, the table motor runs clockwise and the cam rotates from switch “A” and travels toward switch “D.”

16. As the table starts to lower, the stroke limiter solenoid is energized causing the stroke limiter plate to be pulled back away from the T-stop. This allows the table to go down to the new pin setting height and releases the swing shafts on the table allowing the pin holders to go into the vertical pinsetting position.

17. The cam passes switch “D” and at switch “C” the pinholder solenoids energizes to open the grippers, and leave the pins on the pin deck.

18. At switch “B” the pin holder solenoid de-energized closing the gripper.

19. As the table continues to rise, the 7 and 10 pin holder solenoids energize to open the grippers to allow loading of the 7 and 10 pins if they are in the pin station.

20. The table motor raises the table and the sweep until switch “A” is closed.

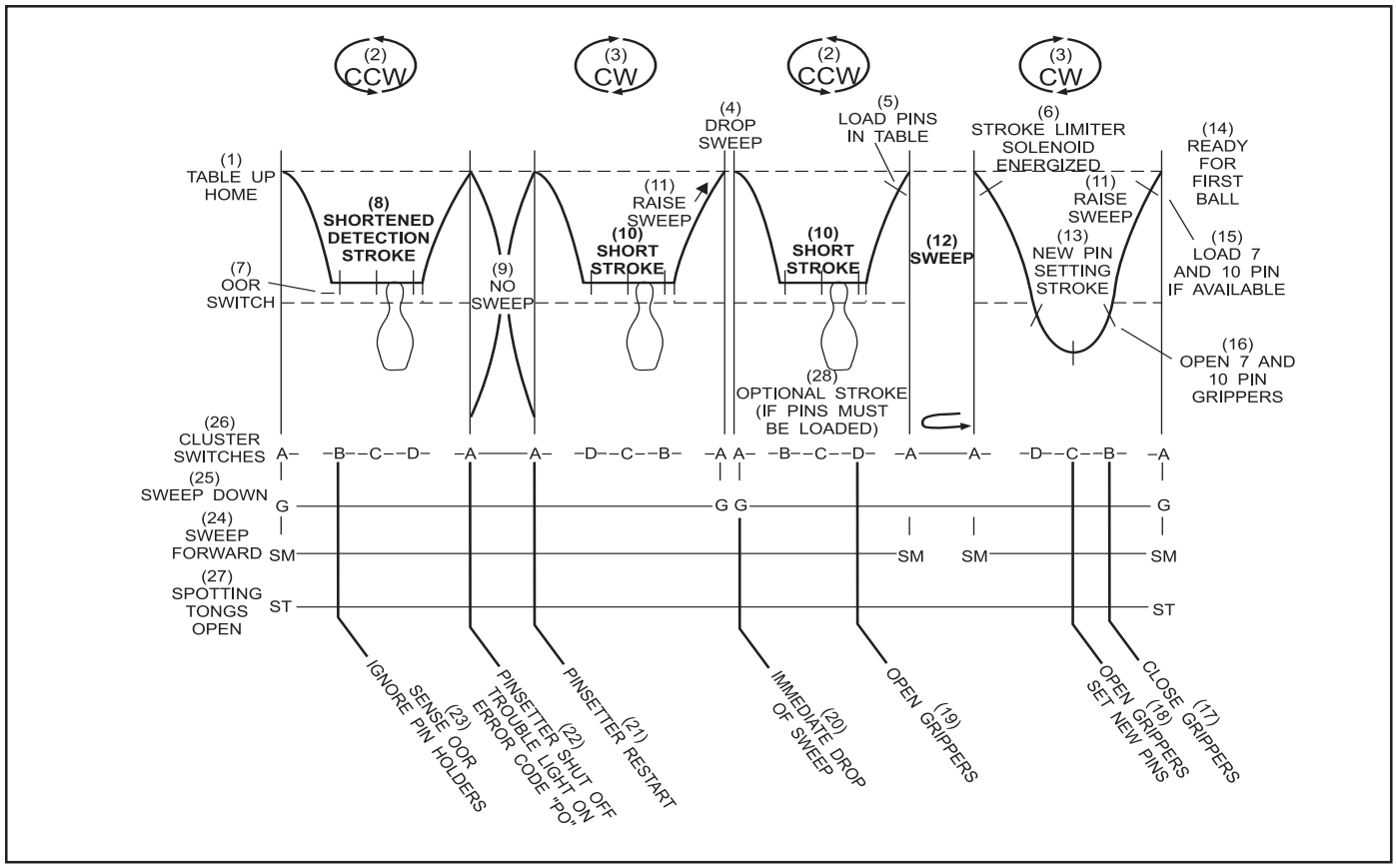

(2) CCW
(3) CW
(2) CCW
(3) CW
(1) TABLE UP HOME
(8) SHORTENED DETECTION STROKE
(7) OOR SWITCH
(9) NO SWEEP
(10) SHORT STROKE
(11) RAISE SWEEP
(4) DROP SWEEP
(10) SHORT STROKE
(5) LOAD PINS IN TABLE
(12) SWEEP
(6) STROKE LIMITER SOLENOID ENERGIZED
(11) RAISE SWEEP
(13) NEW PIN SETTING STROKE
(14) READY FOR FIRST BALL
(15) LOAD 7 AND 10 PIN IF AVAILABLE
(16) OPEN 7 AND 10 PIN GRIPPERS
(28) OPTIONAL STROKE (IF PINS MUST BE LOADED)
(26) CLUSTER SWITCHES
(25) SWEEP DOWN
(24) SWEEP FORWARD
(27) SPOTTING TONGS OPEN
A– –B––C––D– –A——A– –D––C––B– –A A– –B––C––D– –A——A– –D––C––B– –A
G
SM
ST
(23) SENSE OOR IGNORE PIN HOLDERS
(22) PINSETTER SHUT OFF TROUBLE LIGHT ON ERROR CODE "PO"
(21) PINSETTER RESTART
(20) IMMEDIATE DROP OF SWEEP
(19) OPEN GRIPPERS
(18) OPEN GRIPPERS SET NEW PINS
(17) CLOSE GRIPPERS

Figure 4-13. Second Ball Out-Of-Range Cycle.

(1) TABLE UP HOME
(2) COUNTERCLOCKWISE
(3) CLOCKWISE
(4) DROP SWEEP
(5) LOAD PINS IN TABLE
(6) STROKE LIMITER SOLENOID ENERGIZED
(7) OUT-OF-RANGE SWITCH
(8) SHORTENED DETECTION STROKE
(9) NO SWEEP
(10) SHORT STROKE
(11) RAISE SWEEP
(12) SWEEP
(13) NEW PINSETTING STROKE
(14) READY FOR FIRST BALL
(15) LOAD 7 AND 10 PIN IF AVAILABLE
(16) OPEN 7 AND 10 PIN GRIPPERS
(17) CLOSE GRIPPERS
(18) OPEN GRIPPERS SET NEW PINS
(19) OPEN GRIPPERS
(20) IMMEDIATE DROP OF SWEEP
(21) PINSETTER RESTART
(22) PINSETTER SHUT OFF TROUBLE LIGHT ON ERROR CODE "PO"
(23) SENSE OUT-OF-RANGE IGNORE PIN HOLDERS
(24) SWEEP FORWARD
(25) SWEEP DOWN
(26) CLUSTER SWITCHES
(27 SPOTTING TONGS OPEN
(28) OPTIONAL STROKE (IF PINS MUST BE LOADED)

Contents

Section 5: Adjustments 5-3

Ball Detect Adjustment 5-3

Transport Band Tension Adjustment 5-5

Transport Band Drive Belt Tension Adjustment 5-7

Ball Cushion Adjustment 5-8

Front Position 5-8

Side Position 5-9

Ball Cushion Shock Absorber Adjustment 5-10

Ball Door Adjustment 5-11

Ball Door Locking Adjustment 5-12

Ball Accelerator Flat Belt Tension and Alignment Adjustment 5-13

Flat Belt Tension 5-13

Belt Alignment 5-13

Pin Feed Deflector Adjustment 5-15

Elevator Shovel Cam Adjustment 5-16

Elevator Drive Belt Tension Adjustment 5-17

Pin Count Switch Adjustment 5-18

Shark Adjustment 5-19

Pin Station Adjustment 5-21

Pin Overflow Socks 5-22

Setting Table Levelness Adjustment 5-23

“Switch Cluster Cam Timing 5-25

Table Height Adjustment 5-27

Raised Position Measurement 5-27

Lower Position Measurement 5-28

Position Adjustment 5-29

Pin Deck Position 5-31

Distributor Position 5-32

Pin Position Adjustment 5-32
Side to Side 5-33
Forward/Backward 5-34
Pin Detection Height Adjustment 5-36
Stroke Limiter Plate Adjustment 5-38
TS1 Actuator Arm Adjustment 5-40
Pin Holder Swing Shaft's Latch Hook/Horizontal Stop
Bolt Adjustment 5-41
Spotting Tong Drive Adjustment 5-42
Sweep Attenuator / Switch "G" Adjustment 5-44
Sweep Wagon Roller Adjustment 5-45
Sweep Board Height Adjustment 5-46
Sweep Board Gutter Adapter Adjustment 5-48
Distributor Drive Belt Adjustment 5-49
Chain Adjustments 5-50
Drive Motors 5-50
Elevator 5-51
Gear Adjustment - General 5-52
Switch Adjustment - General 5-52

Section 5: Adjustments

Ball Detect Adjustment

WARNING: Before adjusting the ball detector, turn the stop/run switches on the top of the Nexgen Controller box or Mechanic's Remote Display to the stop position. Failure to do this may result in personal injury caused by pinsetter cycling when the ball detect's beam is interrupted or the pinsetter is turned on at the Control Desk.

The ball detect assembly contains three screws that are used to align the units infra red beam with a reflector opposite side of the lane. Refer to *Figure 5-1*.

(1) BALL DETECT
(2) REFLECTOR
(3) DIVISION KICKBACK
(4) BALL RETURN KICKBACK

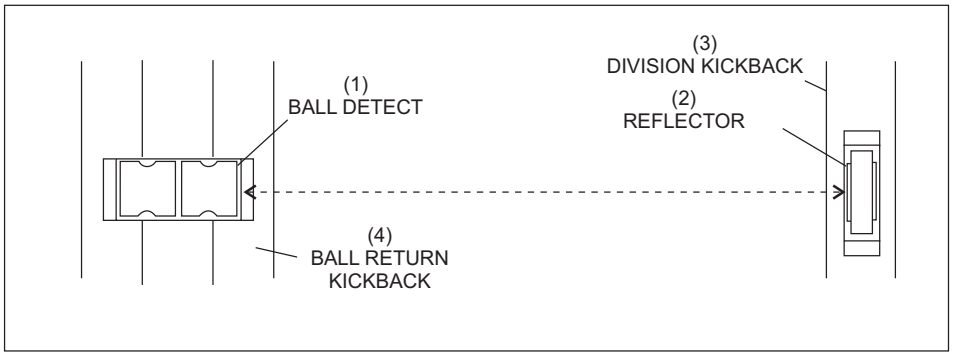


Figure 5-1. Ball Detect and Retroreflector.

The red LED (Light Emitting Diode) mounted on the ball detect is "on" when the beam is not being received back from the reflector. This indicates a ball or some object is in the beam's path or there is an alignment problem. Refer to *Figure 5-2*.

(1) VERTICAL ADJUSTING SCREW
(2) RED LED
(3) HORIZONTAL ADJUSTING SCREW

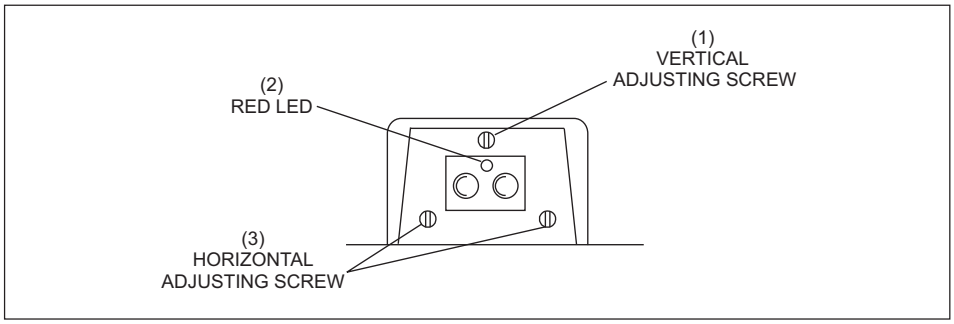


Figure 5-2. Ball Detect Adjusting.

a. Check the face of the ball detect and make sure it is parallel with the face of the ball detect's housing. Check the reflector to see if it is mounted securely and parallel to the ball detect. Clean the transmitter, receiver and reflector before and after adjusting.

b. Cover the reflector with a dark non-reflective object. The red LED should be lit indicating the beam is not being received.

c. Hold an unmounted reflector in your hand and move it above, below and around the mounted reflector until the red LED goes “off.” This will indicate the position of the beam and guide you in your adjustment.

d. Using the vertical and horizontal adjusting screws (refer to *Figure 5-2*) move the beam until it is aimed exactly on the center of the mounted reflector.

Transport Band Tension Adjustment

There are two areas to concentrate on to make sure the transport band rolls properly. First, it must be set to the proper tension and second, it must roll on the front and rear rollers without drifting side to side.

The dimension given below is a starting point that will change slightly when adjusting the transport band to track and center properly.

CAUTION: Before making the tension adjustment, verify that the hardware mounting the transport support frames to the kickback and ball accelerator are tight. Loose hardware will create tracking problems.

a. Tighten the inside jam nut until the spread of the compression spring is 23 to 25 mm. Refer to *Figure 5-3*.

(1) INSIDE JAM NUT
(2) OUTSIDE JAM NUT

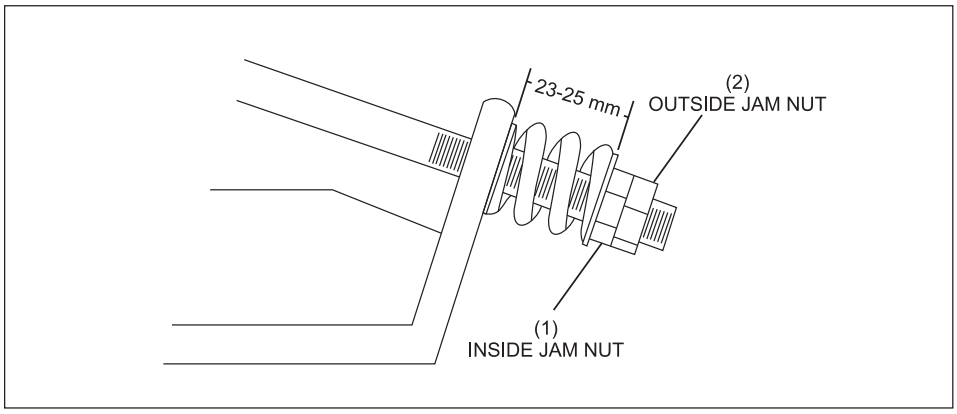


Figure 5-3. Transport Band Tension Using Compression Springs.

b. Cycle the pinsetter and observe any side movement of the band on the rear roller. (Using Diagnostics will load the band with ten pins to help in determining if the tension is proper.)

c. If the band is moving to the left, tighten the inside jam nut on the left side 1/2 turn and loosen the inside jam nut on the right side 1/2 turn. Refer to *Figure 5-3*. If the band is moving to the right, tighten the inside jam nut on the 1/2 turn and loosen the inside jam nut on the left 1/2 turn.

(1) THREADED BOLT FOR TENSIONING
(2) BEARING JAM NUT
(3) INSIDE JAM NUT
(4) OUTSIDE JAM NUT

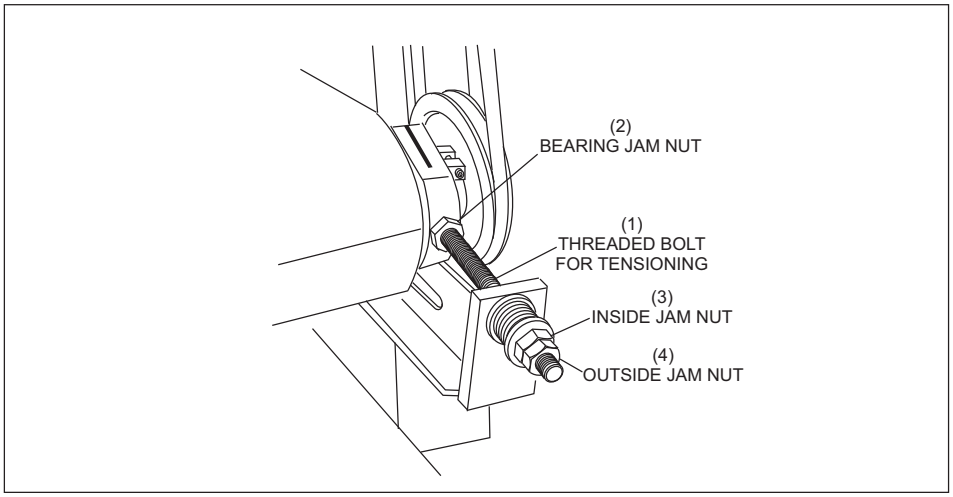


Figure 5-4. Jam Nut for Tensioning the Transport Band.

d.. After each adjustment observe the movement of the transport band. The transport band may move sideways very slowly so allow the pinsetter to run at least 3 - 4 minutes to see any reaction to the change in tension. Repeat step “c” as required until the band is centered and has stopped its sideways movement.

e. Lock the outside jam nut against the inside jam nut to keep the transport band tracking properly on the rollers.

NOTE: *Always remember to tighten the outside jam and bearing jam nuts.*

Transport Band Drive Belt Tension Adjustment

a. Check the length of the green belt between the rear distributor shaft and the transport band drive assembly. The length should be 1.54 m for 12 mm belts or 1.6 m for 15 mm belts.

b. Loosen the tension adjusting screw. Refer to *Figure 5-5*.

(1) TRANSPORT BAND DRIVE ASSEMBLY
(2) V-BELT
(3) TENSION ADJUSTING SCREW
(4) ROUND BELT
(5) SET SCREW

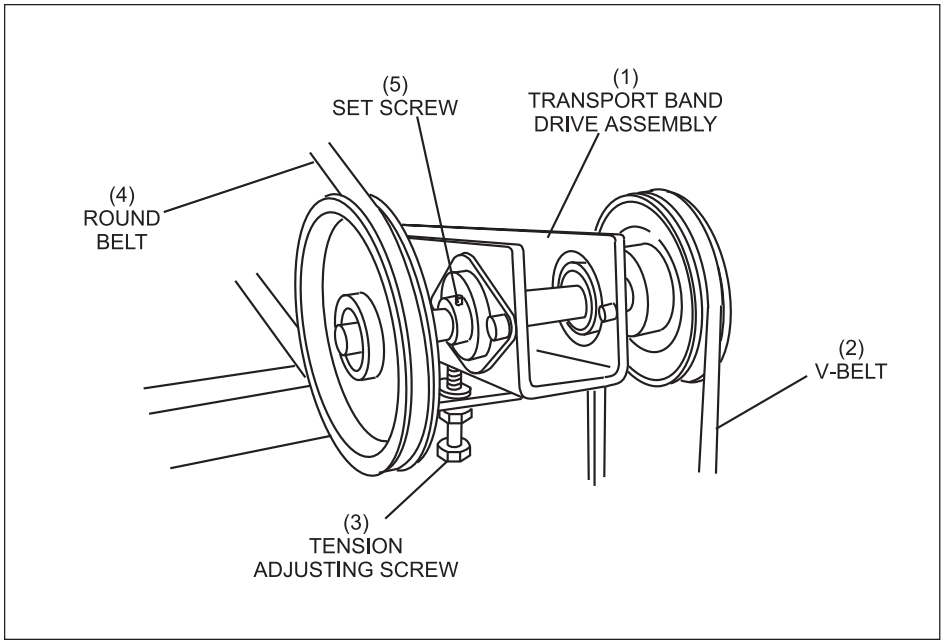


Figure 5-5. Tension Adjustment.

c. Check the green belt and "V" belt to make sure they are seated properly in their pulleys.

d. ***Hand*** tighten the tension adjusting screw as tight as possible.

e. With a 17 mm wrench, tighten the adjusting screw in full turn increments until the belt drives the transport band without slipping.

CAUTION: Do not overtighten the screw as the transport roller may be lifted from the support frame and cause pins to be pushed toward the ball door.

f. Tighten the locknut.

Ball Cushion Adjustment

The function of the ball cushion is to absorb the ball impact and to guide the ball to the ball door for return to the bowler. The front position of the cushion must be set properly so that the ball can enter the ball accelerator without hitting the sides of the edge of ball door opening. The cushion must also be adjusted so that it does not run on the kick backs.

Front Position

a. Using the adjusting bolt shown in *Figure 5-6*, adjust the ball cushion so the front of the cushion is 5 mm in front of the ball protector ring. This will position the ball so it will enter through the ball door without touching the protector ring. Refer to *Figure 5-7*.

(1) RUBBER BUMPER
(2) BEARING BLOCK
(3) ADJUSTING BOLT

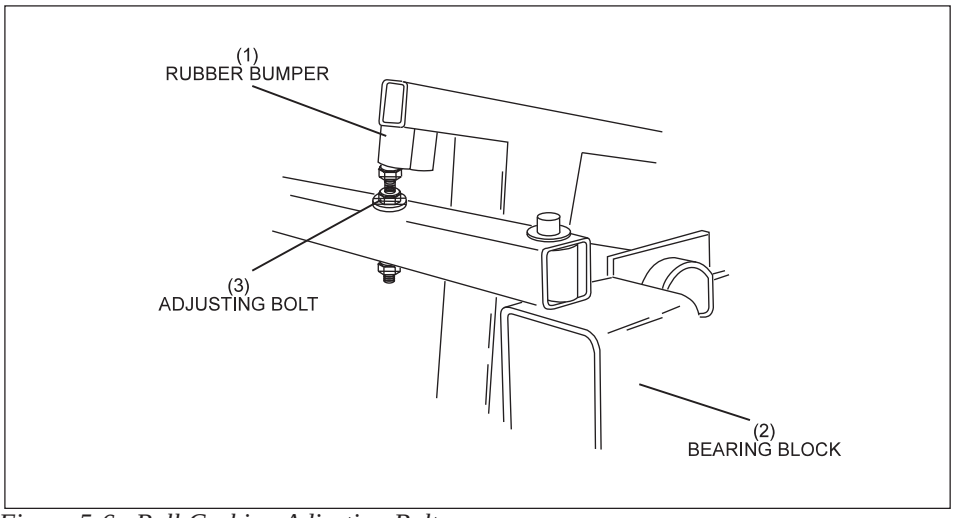


Figure 5-6. Ball Cushion Adjusting Bolt.

(1) BALL DOOR PROTECTOR RING
(2) BALL DOOR
(3) BALL CUSHION

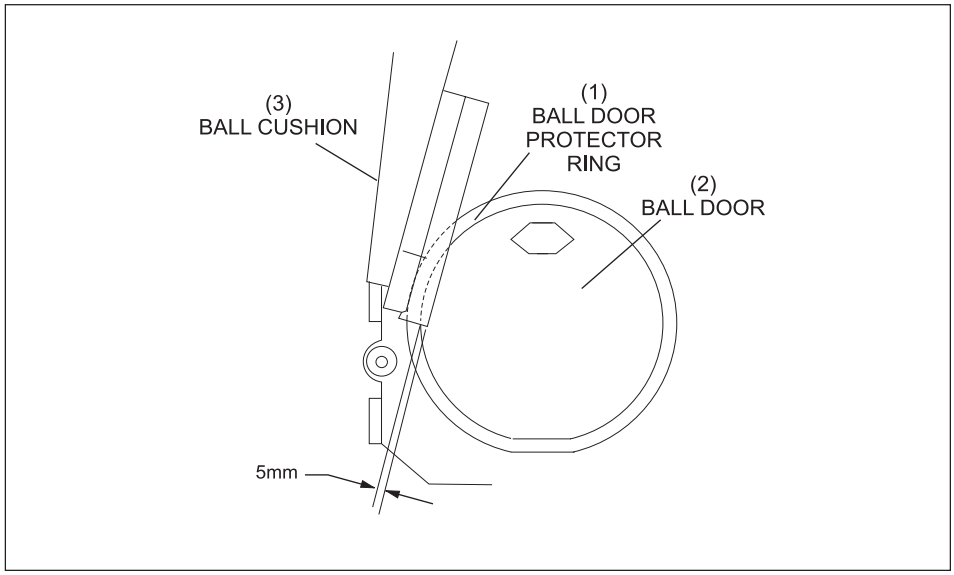


Figure 5-7. Ball Cushion Positioning.

Side Position

Adjust the cushion frame sideways for a proper clearance of 5 mm between the cushion board and the ball protector plate. To adjust, loosen the set screws on the stop collars, reposition the cushion frame, and retighten the set screws. Refer to *Figures 5-8* and *5-9*.

(1) SET SCREW
(2) BALL CUSHION FRAME
(3) BEARING BLOCK
(4) STOP COLLAR

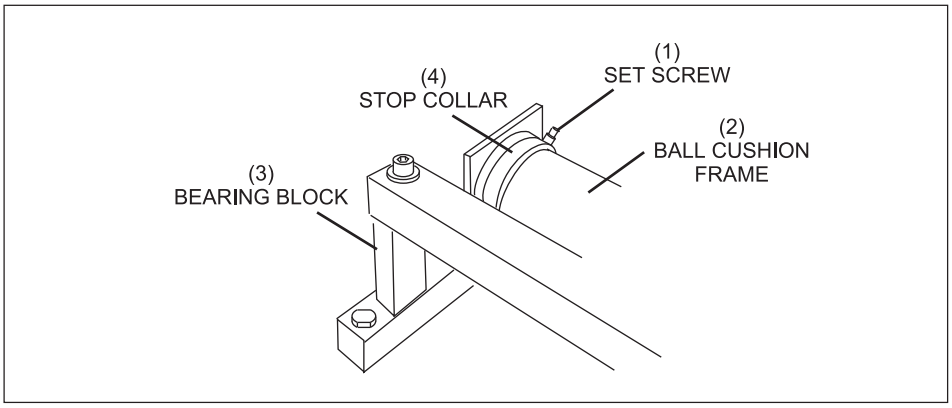


Figure 5-8. Adjust Cushion Frame Sideways.

(1) CLEARANCE OF 5 MM BETWEEN CUSHION BOARD AND BALL PROTECTOR RING

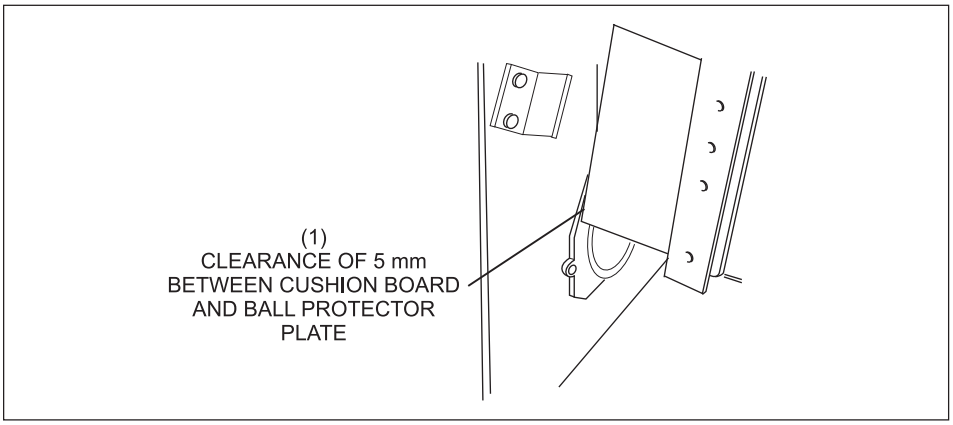


Figure 5-9. 5 mm Clearance Between Cushion Board and Ball Protector Ring.

Ball Cushion Shock Absorber Adjustment

The shock absorber must be adjusted properly to help the ball cushion stop the ball ***and*** to prevent damage to the shock absorber.

a. The ball cushion stop is attached to the ball accelerator housing. Pull the cushion back and position the stop flush against the board. Refer to *Figure 5-10*.

(1) CUSHION BOARD
(2) BALL CUSHION STOP BRACKET

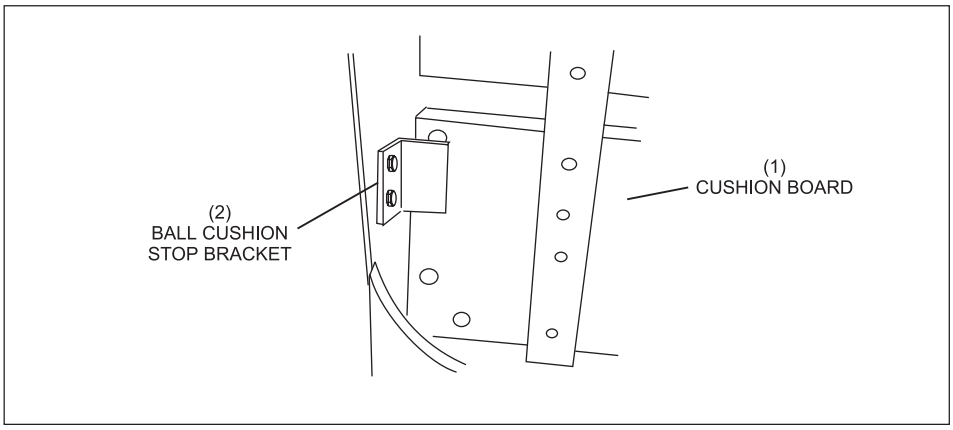


Figure 5-10. Ball Cushion Stop Bracket.

b. Verify that lower locknut and special round nut on shock absorber bracket (*Figure 5-11*) are installed properly. (No threads must be visible below bottom locknut.)

c. With the cushion held against the ball cushion stop, adjust the two upper jam nuts until a gap of 1 mm is obtained between the flat washer and the top of the shock absorber bracket. Refer to *Figure 5-11*. With the ball cushion being held against the ball cushion stop, the shaft must not be bottomed in the shock absorber.

(1) BRACKET
(2) 1 MM GAP
(3) SPECIAL ROUND NUT
(4) LOCKNUT

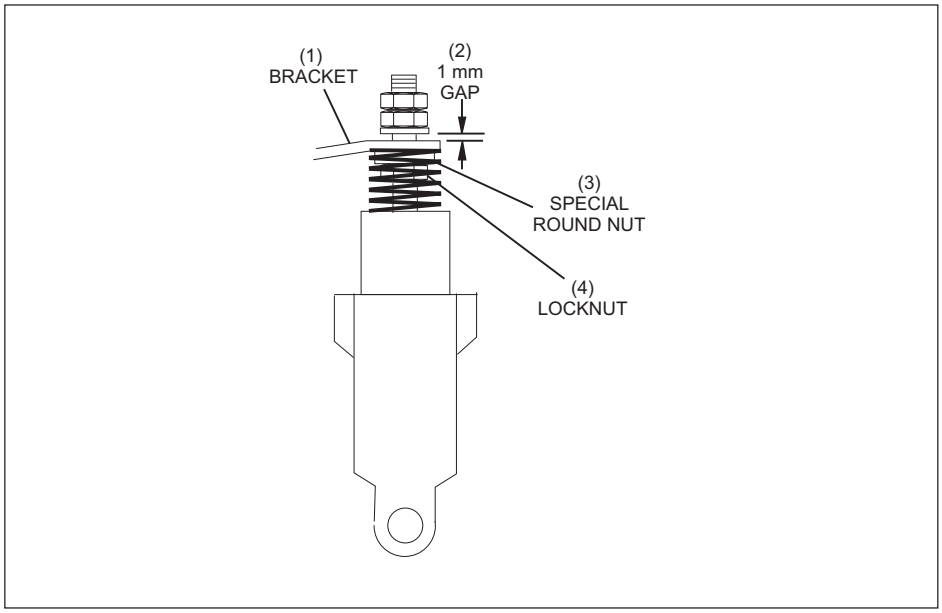


Figure 5-11. Adjust Jam Nuts on Shock Absorber Bracket.

Ball Door Adjustment

The ball doors must be positioned in the ball door openings so that they don't rub on the ball door protector ring or transport band, are level with each other, and have a minimal gap at the top of the ball door shaft. This will allow for complete closing of the ball doors and allow light weight balls to exit with minimum interference. Having the doors at the same height relative to each other prevents the doors from binding on each other as they open and close. A collar on the ball door shaft is used to provide equal spacing at the top and bottom of the ball door. Refer to *Figure 5-12*.

a. Adjust the collar by loosening the set screw and retightening when the door is centered as desired.

b. After adjusting or reinstalling a door, check to see if it is level with the other lane's ball door and that both doors can open and close without any interference.

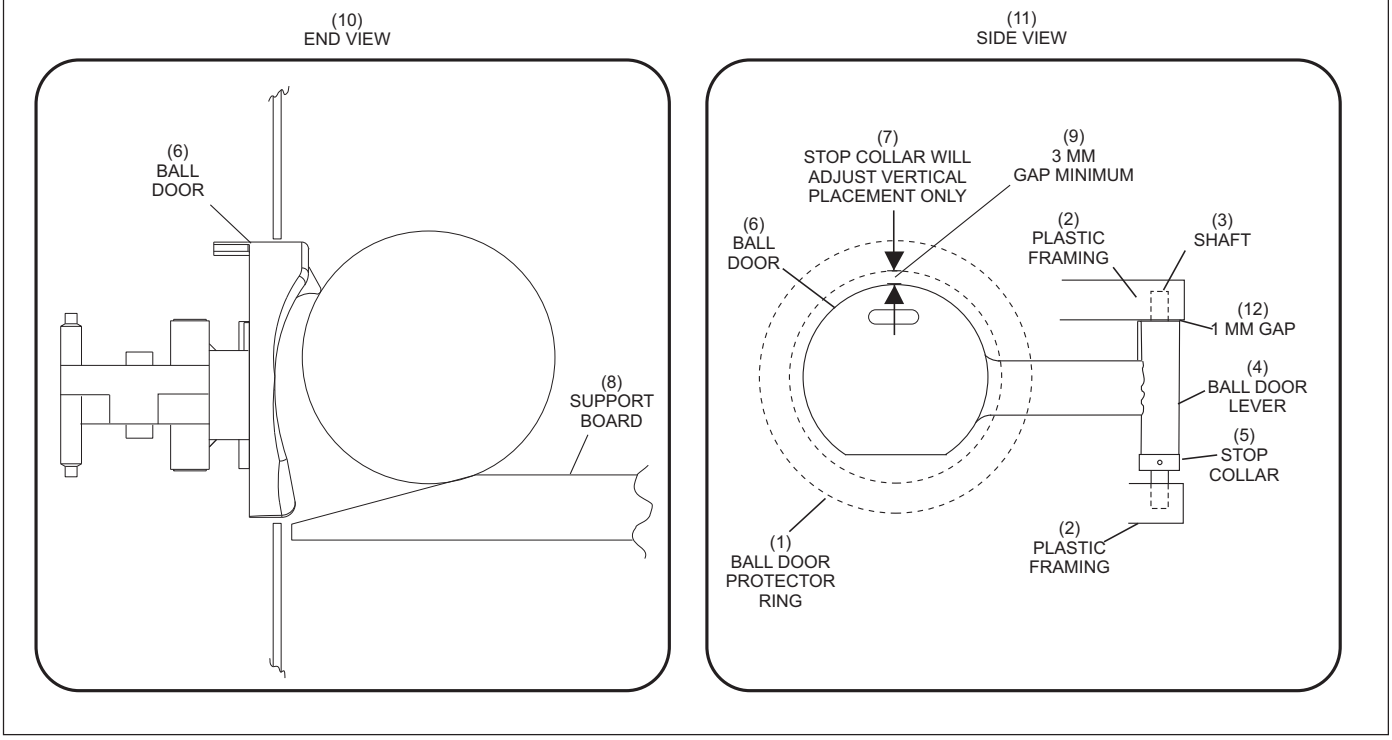


Figure 5-12. Ball Door Centering Adjustment.

(1) BALL DOOR PROTECTOR RING
(2) PLASTIC FRAMING
(3) SHAFT
(4) BALL DOOR ARM
(5) STOP COLLAR
(6) BALL DOOR
(7) STOP COLLAR WILL ADJUST VERTICAL PLACEMENT ONLY
(8) SUPPORT BOARD
(9) 3 mm GAP MINIMUM
(10) END VIEW
(11) SIDE VIEW
12) 1 mm GAP

Ball Door Locking Adjustment

When a ball presses the ball door key, the key lever should lower and clear the locking bolt by 3-5 mm. Refer to *Figure 5-13*. Use the following procedure to adjust the ball door locking assembly.

1. Loosening the two bolts that mount the locking bolt/solenoid assembly to the accelerator frame. Lower the locking bolt assembly.

2. Place a ball on the transport band so that it presses the ball door key causing the door lever to lower.

3. Adjust the locking bolt assembly so that the door lever has a 3-5 mm clearance under the locking bolt when the door button is pushed in.

4. Tighten the two mounting bolts and verify the assembly functions as follows:

    a. The door cannot open by pushing on the door.
    b. The door does open when a ball presses the ball door key.
    c. When the solenoid is energized (plunger pulled in) the door cannot open even if the ball door button is being pressed.

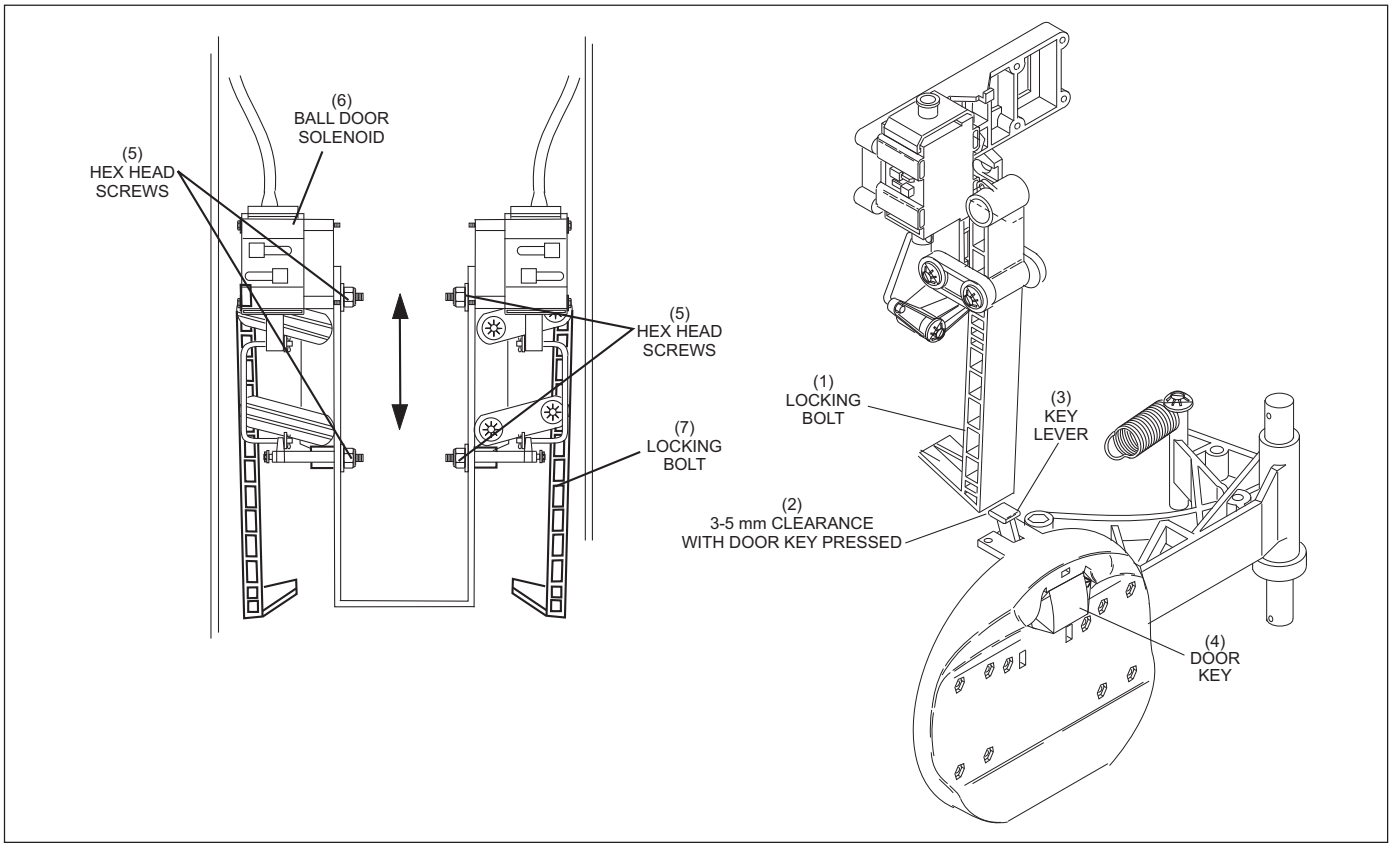


Figure 5-13. Adjusting Locking Bolt.

(1) LOCKING BOLT
(2) 3-5 MM CLEARANCE WITH DOOR KEY PRESSED
(3) KEY LEVER
(4) DOOR KEY
(5) HEX HEAD SCREWS
(6) BALL DOOR SOLENOID
(7) LOCKING BOLT

Ball Accelerator Flat Belt Tension and Alignment Adjustment

Flat Belt Tension

A large tension spring at the front of the accelerator provides the tension for the flat belt. When the belt is under proper tension, this spring will be approximately 185 mm from spring hook to spring hook. Refer to *Figure 5-14*. Adjust by tightening or loosening the two tensioning nuts that secure the long tension bar to the rear of the accelerator frame. Adjust the nuts so that the tension bar threads extend 50mm beyond the outside tension nut.

NOTE: *Access to the spring is only possible when the accelerator is removed from the ball box..*

(1) TENSION BAR
(2) TENSIONING NUTS
(3) ACCELERATOR BELT

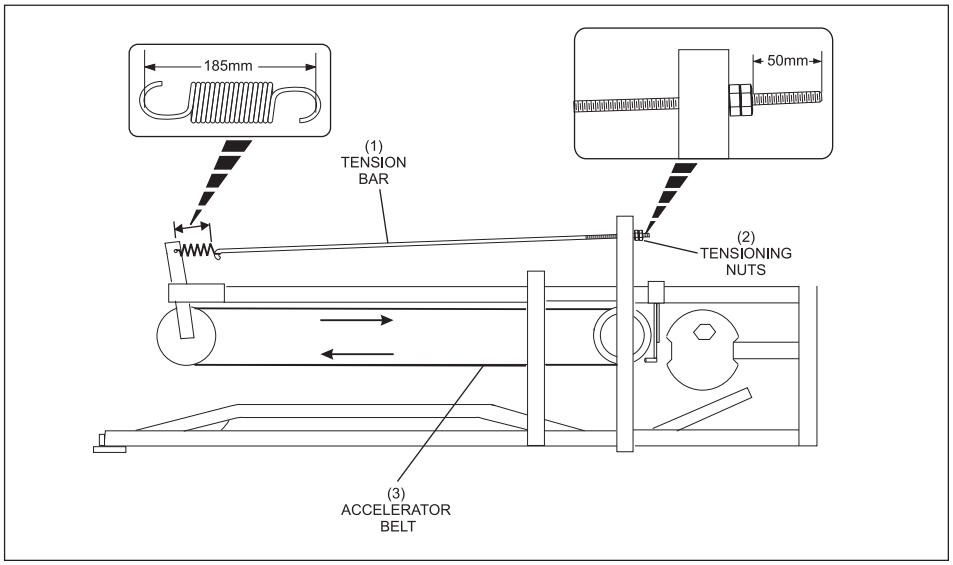


Figure 5-14. Ball Accelerator Flat Belt Tension Adjustment.

Belt Alignment

NOTE: *It is recommended that two people perform the following procedure; one to control power to the accelerator, and one to perform belt tracking adjustment as needed.*

WARNING: The following procedure involves making adjustments to the accelerator with power on and requires close proximity to moving machine parts. Use extreme caution around moving belt to prevent injury to personnel! DO NOT wear loose fitting clothes which may be caught in moving belt!

1. Plug in accelerator power cord and observe belt tracking on front pulley drum.

2. Disconnect the accelerator power cord.

3. If the belt is not centered on the front pulley drum:

   a. Using a 17 mm socket, ratchet and wrench, loosen the two screws and nuts securing the pivot levers. ONLY loosen screws enough to allow slight adjustment of pivot levers. Refer to *Figure 5-15*.

(1) PIVOT LEVERS
(2) TAP HERE
(3) LOOSEN SCREWS
(4) AXIS

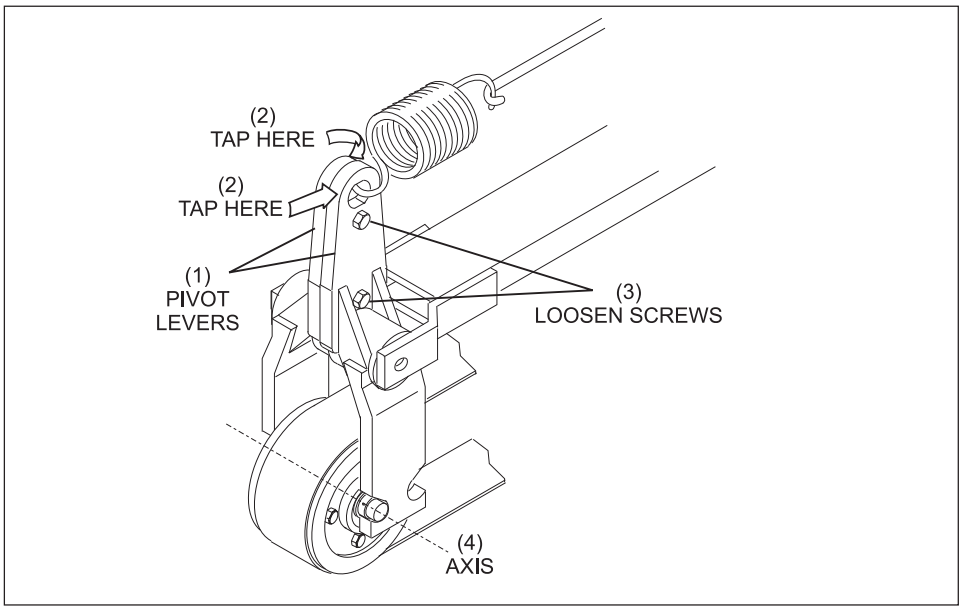


Figure 5-15. Loosen Hardware Securing Pivot Levers.

WARNING: When making adjustments, use care to prevent the belt from slipping off the pulley drum surface. This could damage pivot levers and possibly injure personnel!

   b. Rotate the belt by hand and observe belt tracking. Use light, short taps from a soft rubber mallet to reposition left and right pivot levers until belt is tracking on the center of pulley drum. Refer to *Figure 5-15*.

   c. Reconnect the accelerator power cord and observe the tracking. When the belt is centered, tighten two screws and nuts securing the pivot levers.

Pin Feed Deflector Adjustment

The pin feed deflectors should be positioned so that the defector does not rub on the transport band but is close enough so that pins cannot get wedged under the deflector and the outside edge of the deflectors firmly touch the kickback or ball accelerator. Start with a 6 mm $\pm$ 1.5 mm gap between the transport band and bottom of the deflectors and adjust as needed. Refer to figure 5-16

(1) PIN DEFLECTOR MOUNTING PLATE
(2) MOUNTING HARDWARE
(3) ADJUST FOR 6 MM GAP BETWEEN TRANSPORT BAND AND BOTTOM OF DEFLECTOR
(4) PIN DEFLECTOR

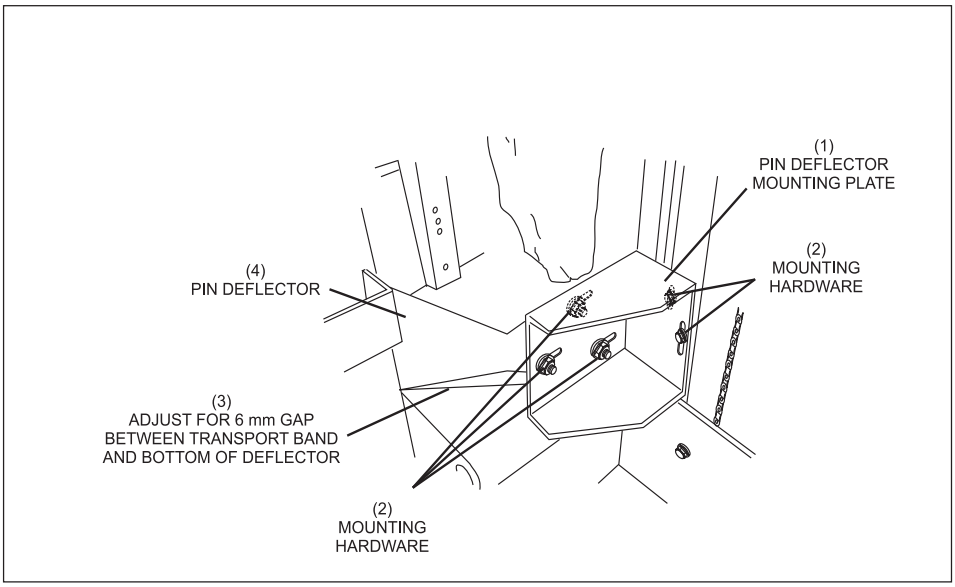


Figure 5-16. Deflector Positioning for Proper Clearance.

Elevator Shovel Cam Adjustment

NOTE: *Prior to making this adjustment, make sure the shark assembly is level and positioned 135 mm from the back plate of the elevator.*

a. Manually position the elevator's pin shovels so the lower surface of the pin shovel is 22 mm ± 2 mm above the top surface of the pin turn wedges. Refer to *Figure 5-17.*

(1) ATTACHING HARDWARE
(2) CENTER LINE ON SHOVEL CAM
(3) LOWER SHOVEL END
(4) PIN TURN WEDGE
(5) WOOD TEMPLATE
(6) PIN SHOVEL GUIDE ROLLER
(7) SHOVEL CAM

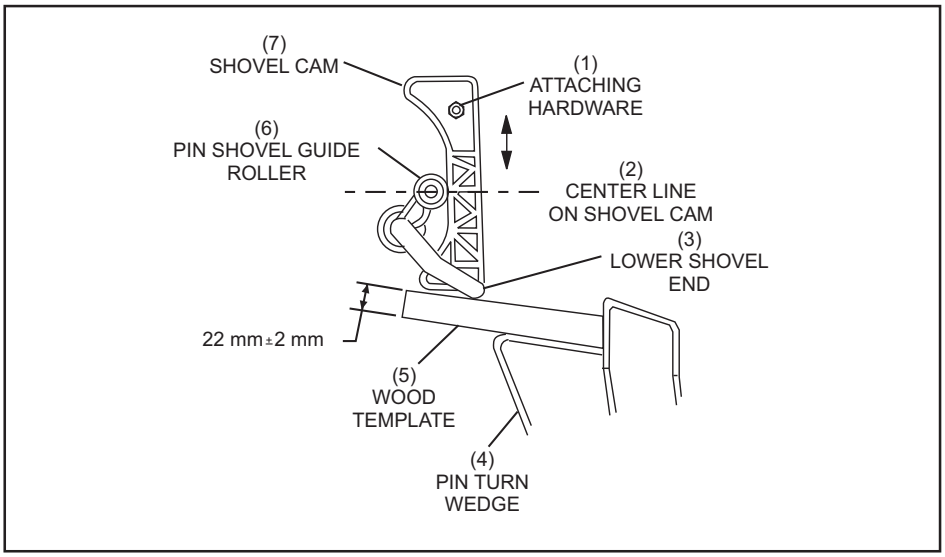


Figure 5-17. Elevator Pin Shovel Cam Adjustment.

b. Loosen the attaching hardware and position the shovel cam so that the pin shovel's guide roller is at the mid point of the cam.

c. Tighten the attaching hardware and check for proper operation.

Elevator Drive Belt Tension Adjustment

a. Check the length of the green belt between the rear distributor shaft and the elevator drive assembly. This length should be 975 mm.

b. Loosen the tension adjusting bolt. Refer to *Figure 5-18*.

(1) ELEVATOR DRIVE PULLEY
(2) TENSION ADJUSTING SCREW
(3) GREEN BELT
(4) V-BELT

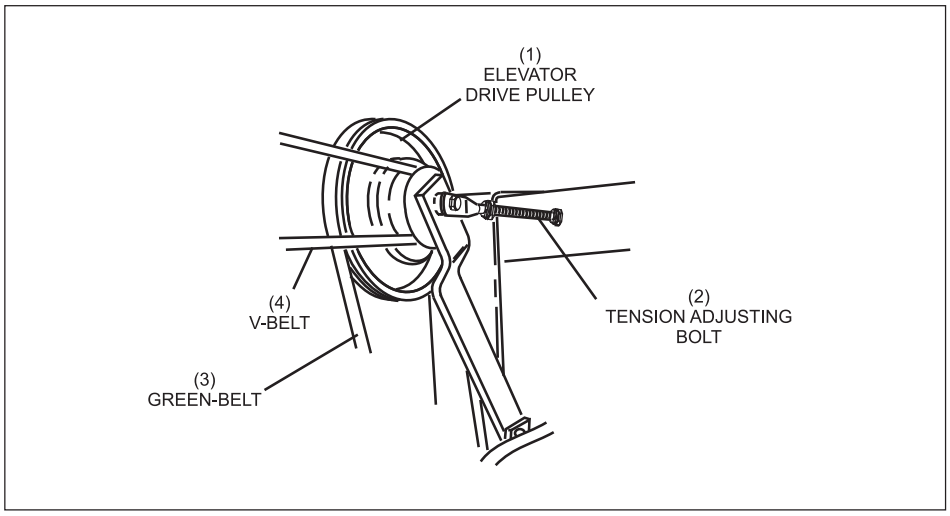


Figure 5-18. Tension Adjustment.

c. Check the green belt and "V" belt to make sure they are seated properly in their pulleys.

d. ***Hand tighten*** the tension adjusting screw and nut as tight as possible.

e. With a 17 mm wrench, tighten the adjusting screw in full turn increments until the belt drives the elevator without slipping.

f. Tighten the jam nut against the rear distributor frame.

Pin Count Switch Adjustment

The pin count switch must be adjusted to make sure that all pins leaving the elevator are counted to insure that the distributor is loaded as efficiently as possible.

NOTE: *Prior to making this adjustment, make sure the shark assembly is level and positioned 135 mm from the back plate of the elevator.*

Loosen the switch actuator clamp and set the switch actuator to the proper dimensions. Retighten the clamp. Refer to *Figure 5-19.*

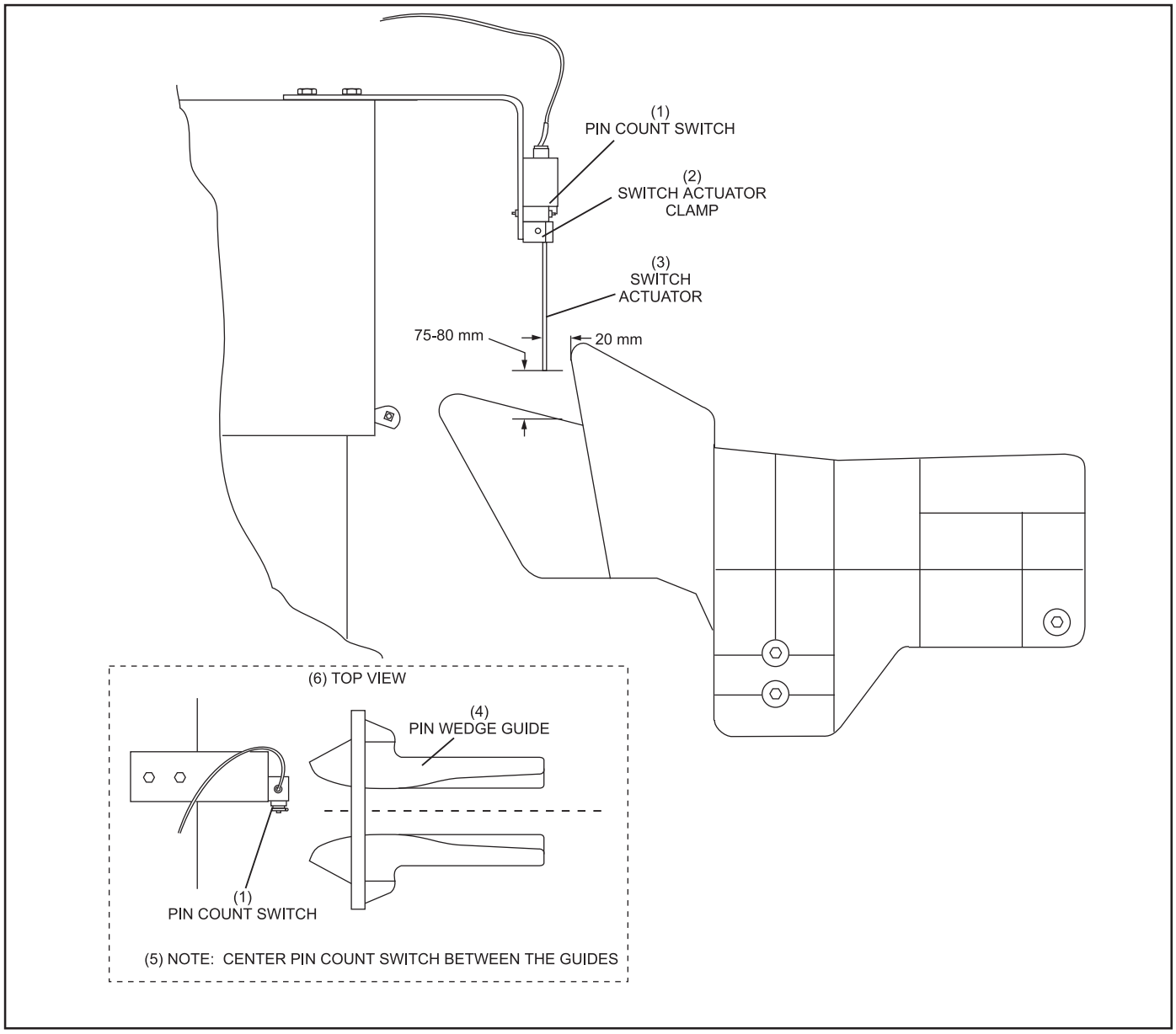


Figure 5-19 Pin Count Switch.

(1) PIN COUNT SWITCH
(2) SWITCH ACTUATOR CLAMP
(3) SWITCH ACTUATOR
(4) PIN WEDGE GUIDE
(5) NOTE: CENTER PIN COUNT SWITCH BETWEEN THE GUIDES
(6) TOP VIEW

Shark Adjustment

The upper rear corner of each pin turn wedge must be 135 mm ± 3 mm from the rear plate of the elevator and there must be approximately 1-2 mm tooth gap at the gears between the shark assembly and the distributor. To verify proper tooth gap, check for 1-2 mm of movement by manually moving the belt forward and backward. Refer to *Figure 5-20.* This will allow for the proper placement of the pins into the shark assembly.

a. Loosen the pin turn wedge mounting hardware and position the wedge to 135 mm. Retighten the hardware. Refer to *Figure 5-20.*

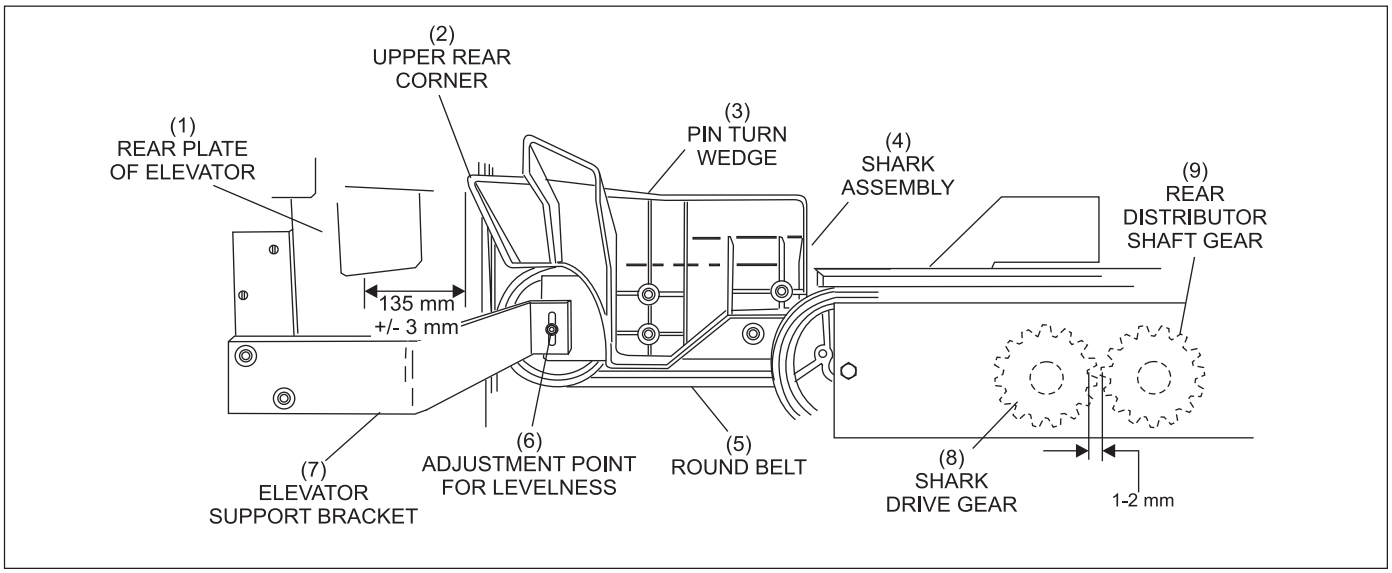


Figure 5-20. Pin Turn Wedge Positioning.

(1) REAR PLATE OF ELEVATOR
(2) UPPER REAR CORNER
(3) PIN TURN WEDGE
(4) SHARK ASSEMBLY
(5) ROUND BELT
(6) ADJUSTMENT POINT FOR LEVELNESS
(7) ELEVATOR SUPPORT BRACKET
(8) SHARK DRIVE GEAR
(9) REAR DISTRIBUTOR SHAFT GEAR

b. Adjust the shark assembly so that the pin turn wedges are level side to side and up slightly from back to front. (approximately 2 degrees or 1/2 bubble on the level). Refer to *Figure 5-21* and *Figure 5-22* to properly position the level and *Figure 5-20* for the adjustment location.

(1) PIN GUIDE WEDGES
(2) LEVEL
(3) SHARK FIN
(4) ROUND BELTS

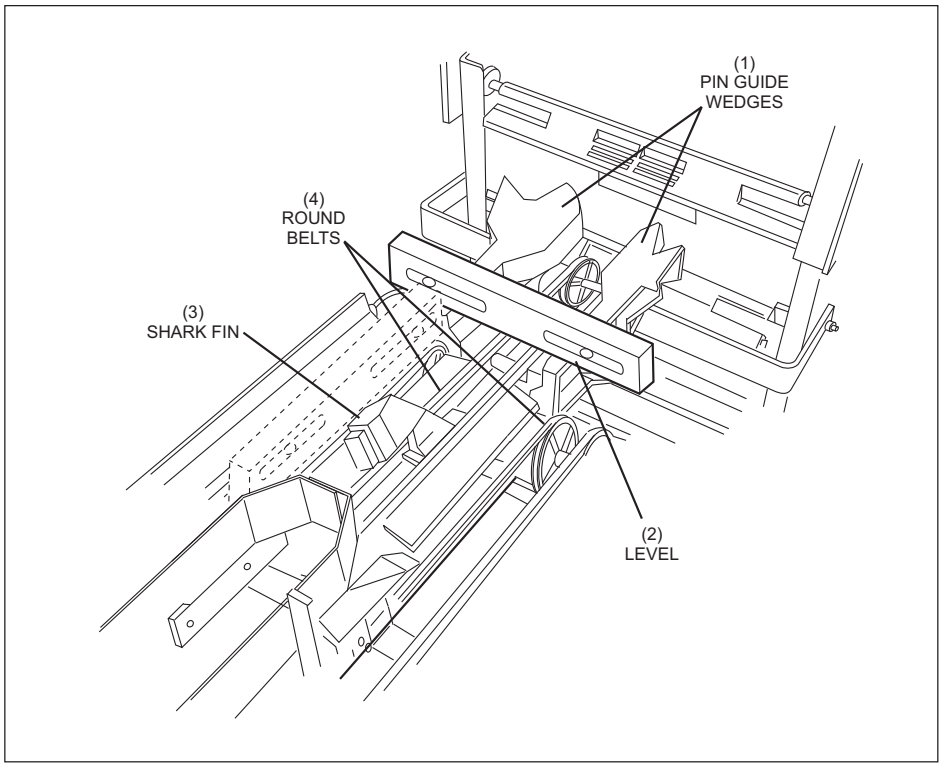


Figure 5-21. Shark Switch Leveling Adjustment - Side to Side.

(1) PIN GUIDE WEDGES
(2) LEVEL
(3) SHARK FIN
(4) ROUND BELTS

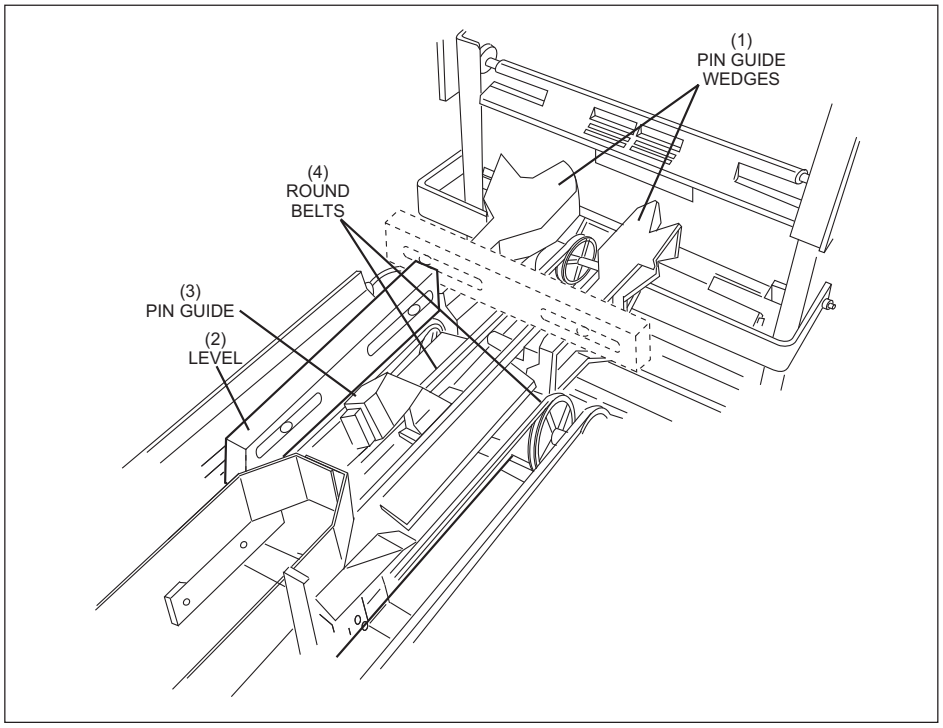
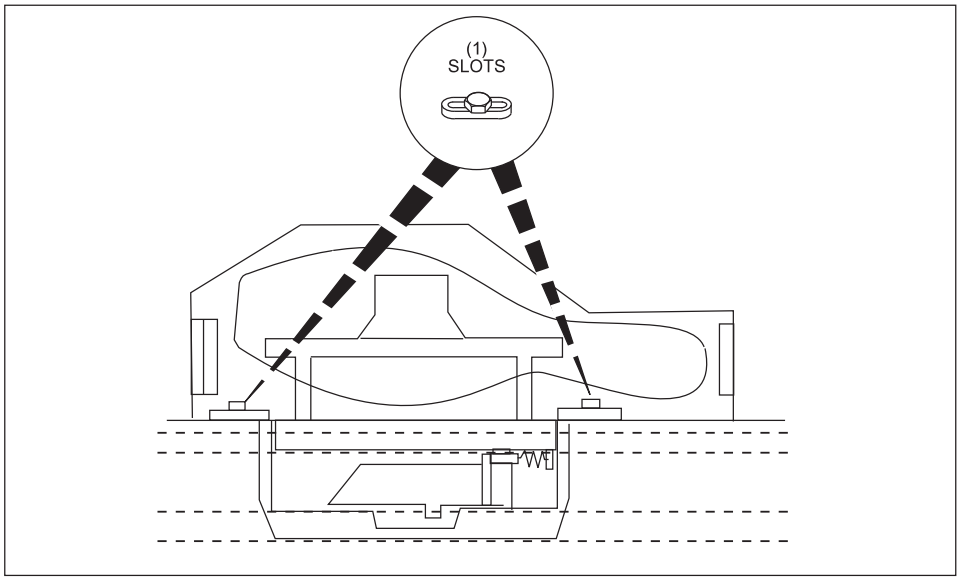


Figure 5-22. Shark Switch Leveling Adjustment - Front to Back.

Pin Station Adjustment

Each pin station has four mounting slots that provide rearward and forward adjustment. Refer to *Figure 5-23*.

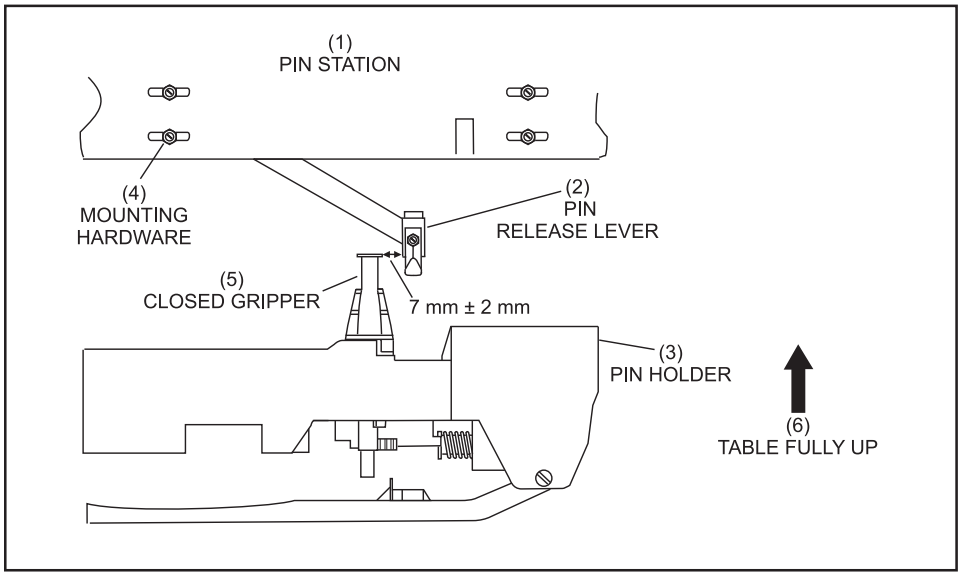


(1) SLOTS

Figure 5-23. Position of Pin Station in Distributor.

With the setting table at the highest point (switch "A" actuated), measure the clearance between the bottom leg of the pin release lever and the "closed" gripper. A clearance of 7 mm $\pm$ 2 mm should be visible between each pin release lever and the closed pinholder gripper. Refer to *Figure 5-24*.

To adjust a pin station, loosen the mounting hardware and position the assembly to obtain the 7 mm $\pm$ 2 mm .



(1) PIN STATION
(2) PIN RELEASE LEVER
(3) PIN HOLDER
(4) MOUNTING HARDWARE
(5) CLOSED GRIPPER
(6) TABLE FULLY UP

Figure 5-24. Universal Pin Release Lever.

Pin Overflow Socks

The overflow socks must be clamped and adjusted properly to prevent any overflow pins from causing distributor or ball door jams, transfer the pin quickly to the elevator and to provide swing clearance for the sock.

A minimum of 25 mm (1") of the sock must be above the clamp to insure sufficient clamping strength when mounting the sock onto the overflow chute.

The overflow socks must face each other so the pin lands on the transport band ***between*** the rear transport band roller and the rear support board. When the socks are properly adjusted the pin should enter the elevator efficiently and the sock should not come in contact with the pin feed deflector or any other part of the pinsetter as a pin exits the sock. Refer to *Figure 5-25*.

(1) OVERFLOW SOCKS
(2) REAR BOARD
(3) REAR TRANSPORT BAND ROLLER

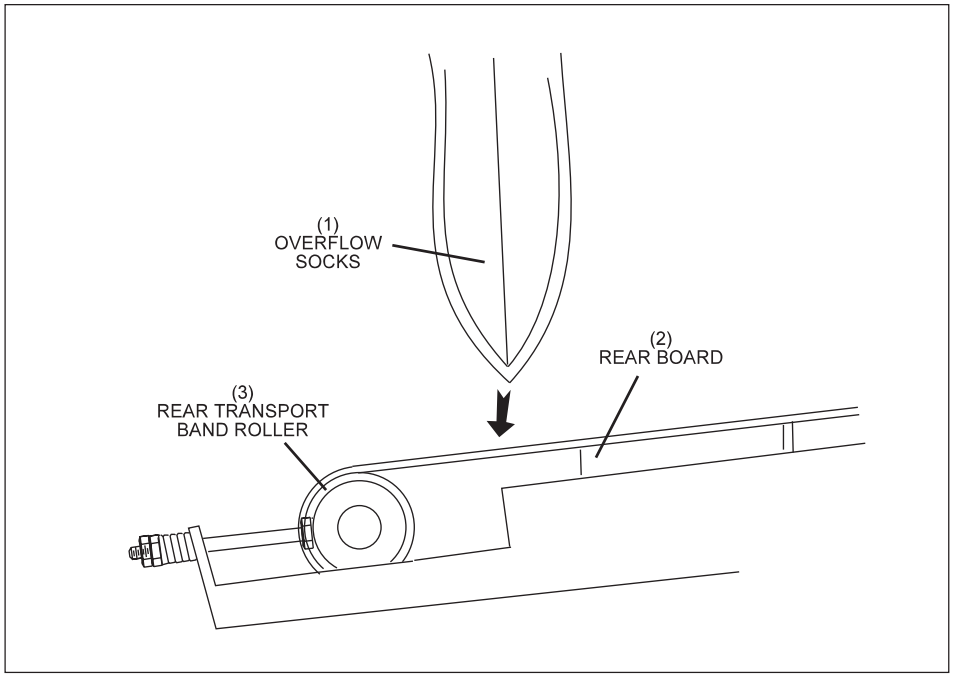


Figure 5-25. Sock Placement.

Setting Table Levelness Adjustment

The setting table must be level in order for pins to be loaded and set properly.

a. With the table at home position check the front, back and side to side position of the table tube using a level. Refer to *Figure 5-26*. If adjustment is needed, loosen the 24 mm hex nuts on the setting table studs. Refer to Figure 5-27. Adjust the roller guides and bearing block as needed to obtain a level tube guide.

(1) LEVEL
(2) TABLE GUIDE
(3) TUBE GUIDE
(4) ROLLER GUIDE

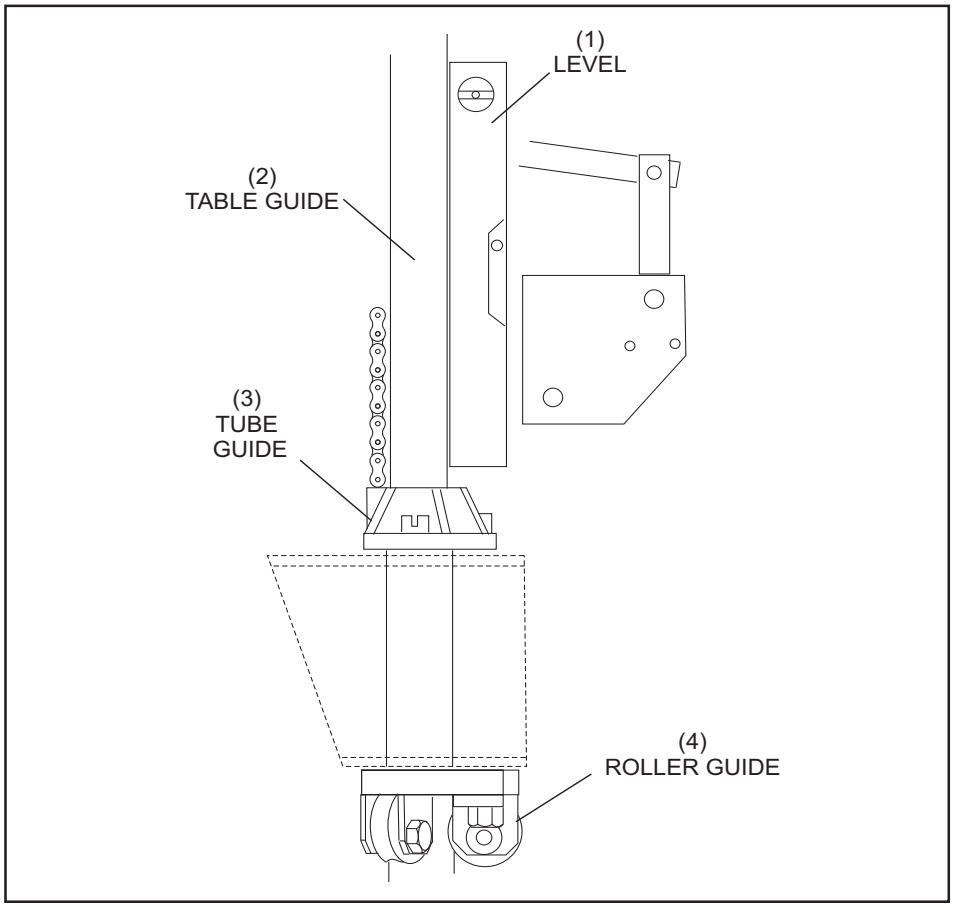


Figure 5-26. Table Rack Guide Rollers.

b. Lower the setting table to the new pinsetting position and shut off the power when the grippers open.

c. Manually rotate the table motor "V" belt pulley until the setting table's crank arm and the lift chain form a straight line as shown in *Figure 5-28*. (Refer to the Service section of this manual for the proper table lowering procedure.)

d. Measure the height of the setting table from the pin deck to the bottom of the setting table frame at the the 1, 7 and 10 pin positions. The dimension at these three points must be within 3 mm of each other.

CAUTION: Do not lean on the table while checking these measurements.

e. To adjust, lower or raise the large hex nuts (24 mm socket and drive required) on the setting table's studs until the table is level. Refer to *Figure 5-27*.

NOTE: This adjustment is used to level the table. It is not used to adjust the table height from the pindeck Refer to Setting Table Height Adjustment to achieve the correct table height.

(1) 24 mm HEX NUT AND LOCKWASHER
(2) SETTING TABLE STUDS
(3) DECK RACK

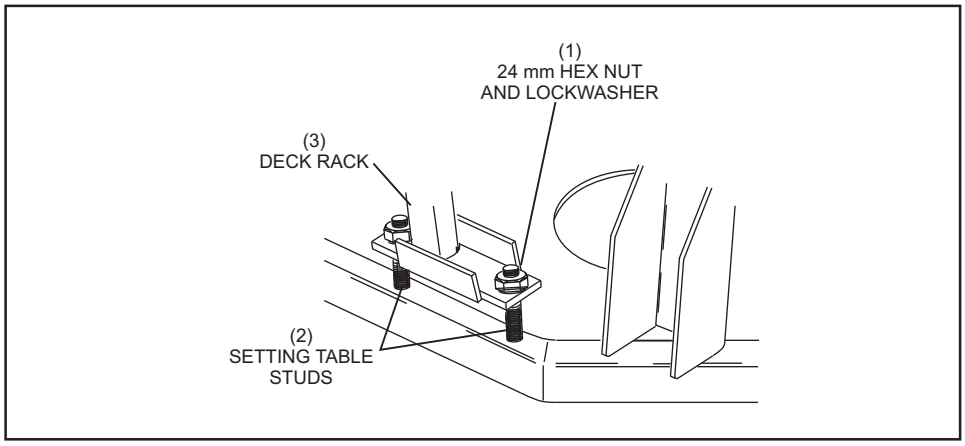


Figure 5-27. Setting Table Studs.

f. Tighten the 24 mm hex nuts.

"Switch Cluster Cam Timing

The purpose of the cam timing adjustment is to ensure that the switch cluster switches accurately indicate the position of the setting table regardless of the direction the table motor is operated (clockwise or counterclockwise.). Improper timing can cause scoring problems, hinder the machines ability to pick up or spot pins, and in some cases cause the table and sweep to collide. Adjust the timing as follows:

a. Position the setting table so that the drive chain intersects the center line of the crank arm. Refer to *Figure 5-28.*

(1) CENTER LINE OF CRANK ARM
(2) DRIVE CHAIN
(3) CRANK ARM
(4) SPROCKET

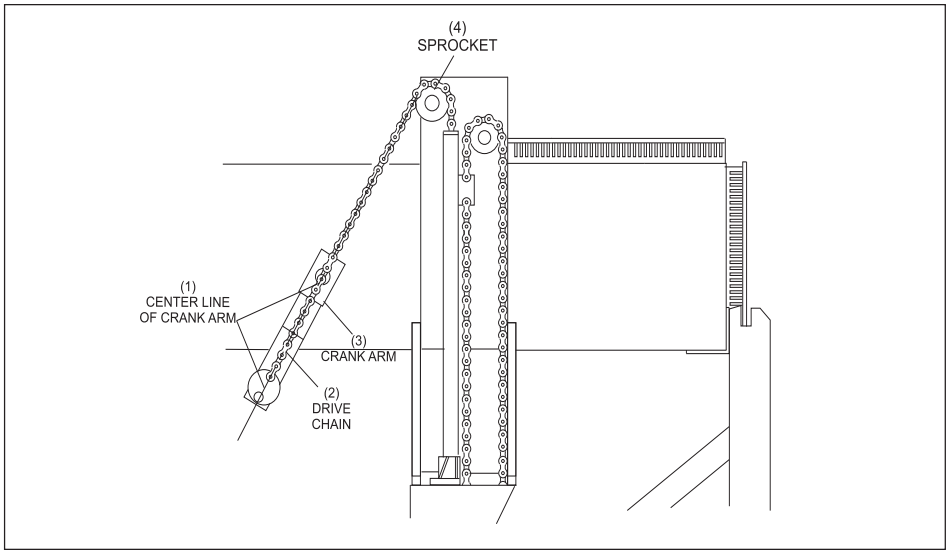


Figure 5-28. Drive Chain Position

b. Loosen the cam and position it so that the middle of the magnet is at the peak of the switch actuator arm. Retighten the cam. Refer to *Figure 5-29.*

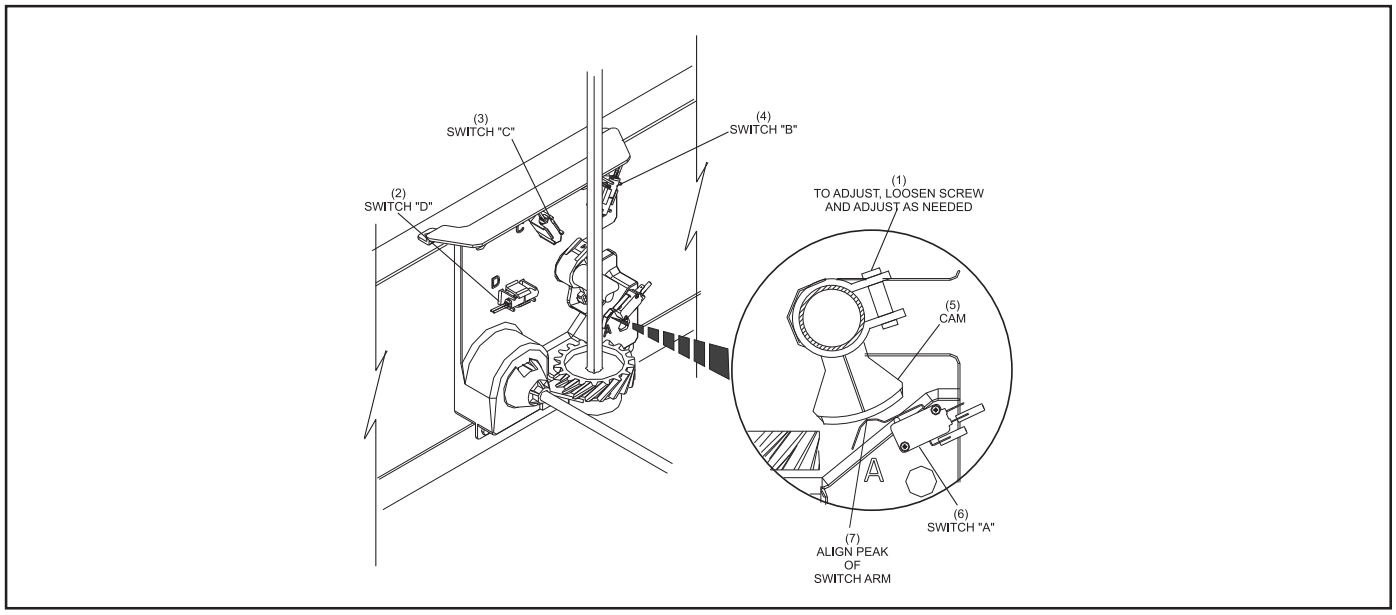


Figure 5-29. Cam Position

(1) TO ADJUST, LOOSEN SCREW AND ROTATE CAM AS REQUIRED
(2) SWITCH "D"
(3) SWITCH "C"
(4) SWITCH "B"
(5) CAM
(6) SWITCH "A"
(7) ALIGN PEAK OF SWITCH ARM

c. To verify the timing is correct, compare the distance the drive chain is offset from the center line of the crank arm when the table motor turns off at the "A" switch after running clockwise and counterclockwise. The offset distances or angles should be equal. Refer to *Figure 5-30*.

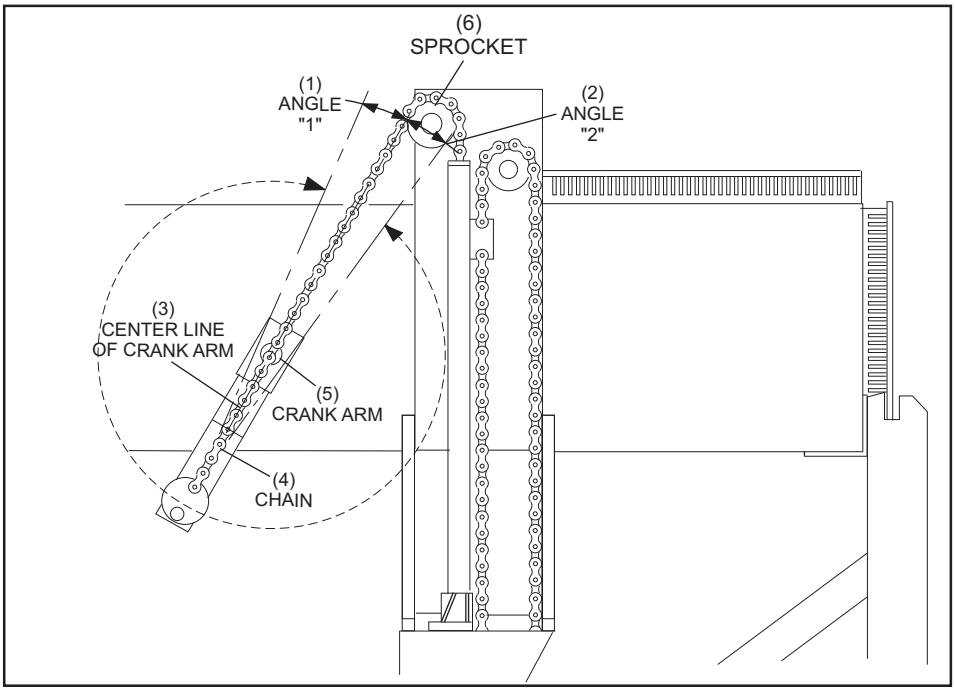


Figure 5-30 Chain Angles - Clockwise vs Counter-Clockwise

Table Height Adjustment

NOTE: *Prior to making any of the following table adjustments, it is necessary that the setting table is level with the pin deck and that switch cluster cam timing is set correctly. Refer to the "Switch Cluster Cam Timing Adjustment.*

CAUTION: After changing the chain position on the pivot bearing or the length of the crank arm, you must verify that the pivot bearing does not come in contact with the main sweep arm before operating the pinsetter. Additional clearance may be achieved by removing the pivot bearing from the crank arm shaft, flipping it over, and reinstalling it.

The table height must be measured at two places to determine if adjustment is required. First the table must raise to home position so that it is at it's typical distance from the distributor **and** second, the table must lowered so that the drive chain is extended fully from the crank arm.

Raised Position Measurement

With the setting table in its raised (home) position, measure the distance from top of the swing shaft support, near the 3 pin or 6 pin, to the bottom of the distributor frame. The target distance is **140 mm +/- 2 mm.** *Figure 5-31.*

(1) DISTRIBUTOR FRAME
(2) SWING SHAFT SUPPORT
(3) SETTING TABLE

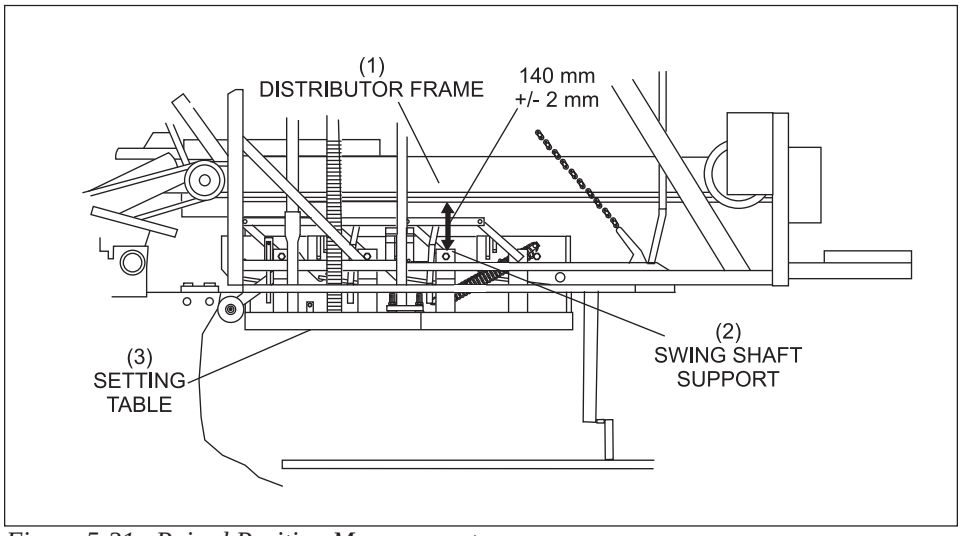


Figure 5-31. Raised Position Measurement.

Lower Position Measurement

With the table in its lowest position measure from the pin deck to the bottom of the table frame. Refer to *Figure 5-32 and Figure 5-33.*

(1) SPROCKET
(2) TS-2 SWITCH
(3) OOR SWITCH
(4) CHAIN LENGTH PIVOT BEARING
(5) TABLE SHAFT
(6) CRANK ARM
(7) CRANK ARM ADJUSTMENT SCREWS
(8) TABLE LIFT CHAIN

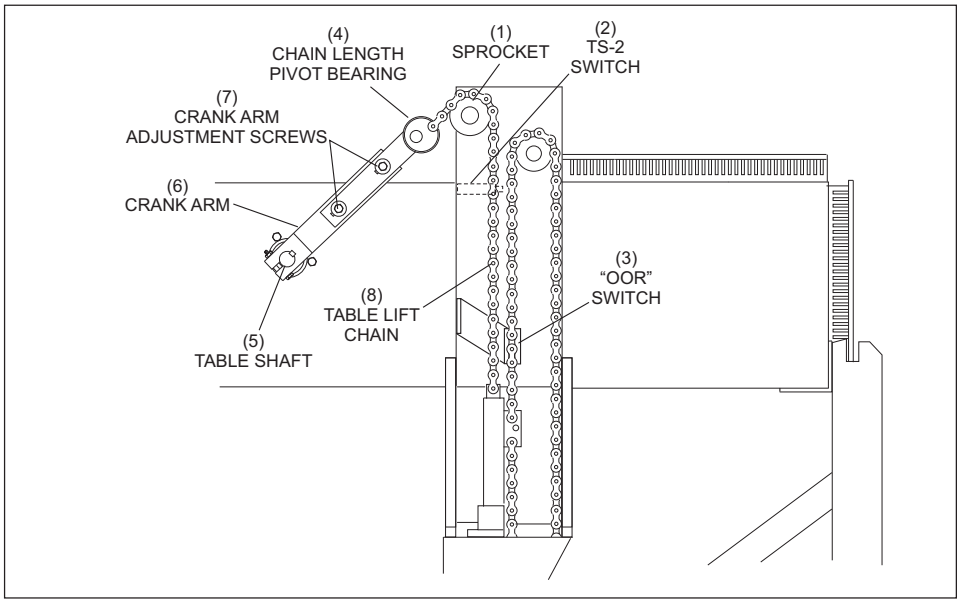


Figure 5-32. Table in Lowest Position

The proper height for the table in this position is **10 mm - 15 mm** from the lane surface to the bottom of the table. Refer to *Figure 5-33*. Check this dimension at the 1, 7, and 10 pin spots to make sure it is level as well as being at the proper height.

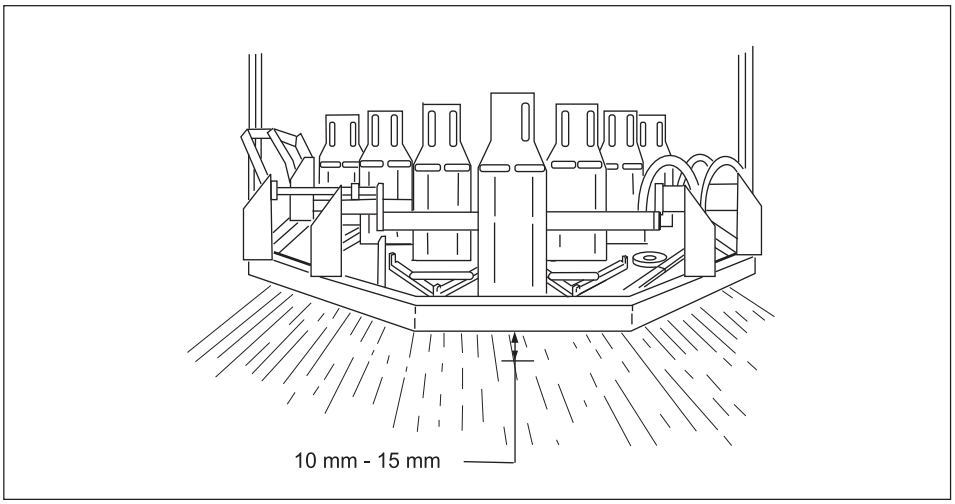


Figure 5-33. Checking Table's Lowest Position.

Position Adjustment

If adjustment is necessary, lower the table so it rests fully on the stroke limiter plate or other suitable support. This releases the tension on the chain and crank arm.

Use the *Table Height Adjustment Chart, Figure 5-32, Figure 5-34, 5-35* and *Figure 5-36,* to adjust the table height to the required position.

CAUTION: After changing the chain position on the pivot bearing or the length of the crank arm, you must verify that the pivot bearing does not come in contact with the main sweep arm before operating the pinsetter. Additional clearance may be achieved by removing the pivot bearing from the crank arm shaft, flipping it over, and reinstalling it.

NOTE: *If both the crank and the chain are being adjusted they should each be moved equally one half the total distance desired.*

Example 1: *The position at the pindeck is OK but the table is 6 mm too far from the distributor. To raise the top position only, shorten the chain 3 mm and lengthen the crank arm 3 mm.*

Example 2: *The table is 4 mm to close to the pindeck and is 4 mm too far from the distributor. Shorten the chain 4 mm.*

Table Height Adjustment Chart

Table Height Change Needed	Direction	Corrective Action
Adjust Position at Distributor Only	Raise the Table	Shorten the Chain and Lengthen the Crank equally
	Lower the Table	Shorten the Crank and Lengthen the Chain equally
Adjust Position at Pin Deck Only	Raise the Table	Shorten the Chain and Shorten the Crank equally
	Lower the Table	Lengthen the Chain and Lengthen the Crank equally
Adjust Both Positions in the Same Direction	Raise the Table	Shorten the Chain only No change to the Crank
	Lower the Table	Lengthen the Chain only No change to Crank
Adjust Both Positions in Opposite Directions	Lower Highest Raise Lowest	Shorten the Crank only No change to the Chain
	Raise Highest Lower Lowest	Lengthen the Crank only No change to Chain

Table Height Adjustment Chart.

(1) HOLE 1
(2) HOLE 2
(3) HOLE 3 (FACTORY DEFAULT)
(4) HOLE 4
(5) HOLE 5
(6) HOLE 6
(7) HOLE 7
(8) FRONT VIEW
(9) BACK VIEW

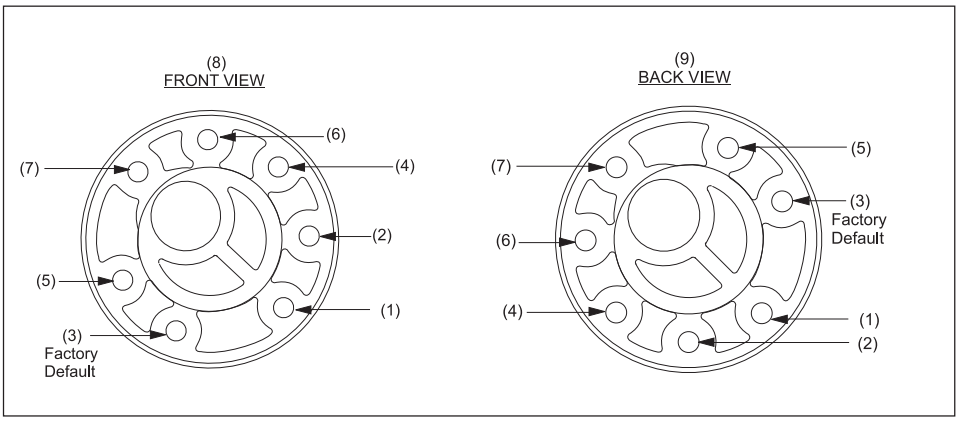


Figure 5-34. Chain Pivot Bearing

Curent Hole	Move to Hole						
	1	2	3	4	5	6	7
1	NC	S2	S4.9	S7.5	S11.4	S14.4	S18
2	L2	NC	S2.9	S5.5	S9.4	S12.4	S16
3	L4.9	L2.9	NC	S2.6	S6.5	S9.54	S13.1
4	L7.5	L5.5	L2.6	NC	S3.9	S6.9	S10.5
5	L11.4	L9.4	L6.5	L3.9	NC	S3	S6.6
6	L14.4	L12.4	L9.5	L6.9	L3	NC	S3.6
7	L18	L16	L13.1	L10.5	L6.6	L3.6	NC

Figure 5-35. Pivot Bearing Dimensions

NOTE: *L = Lengthen, S = Shorten, NC = No Change. All numbers are in millimeters. Example: Moving from hole 1 to hole 2 S2 = Shortens the chain 2 mm.*

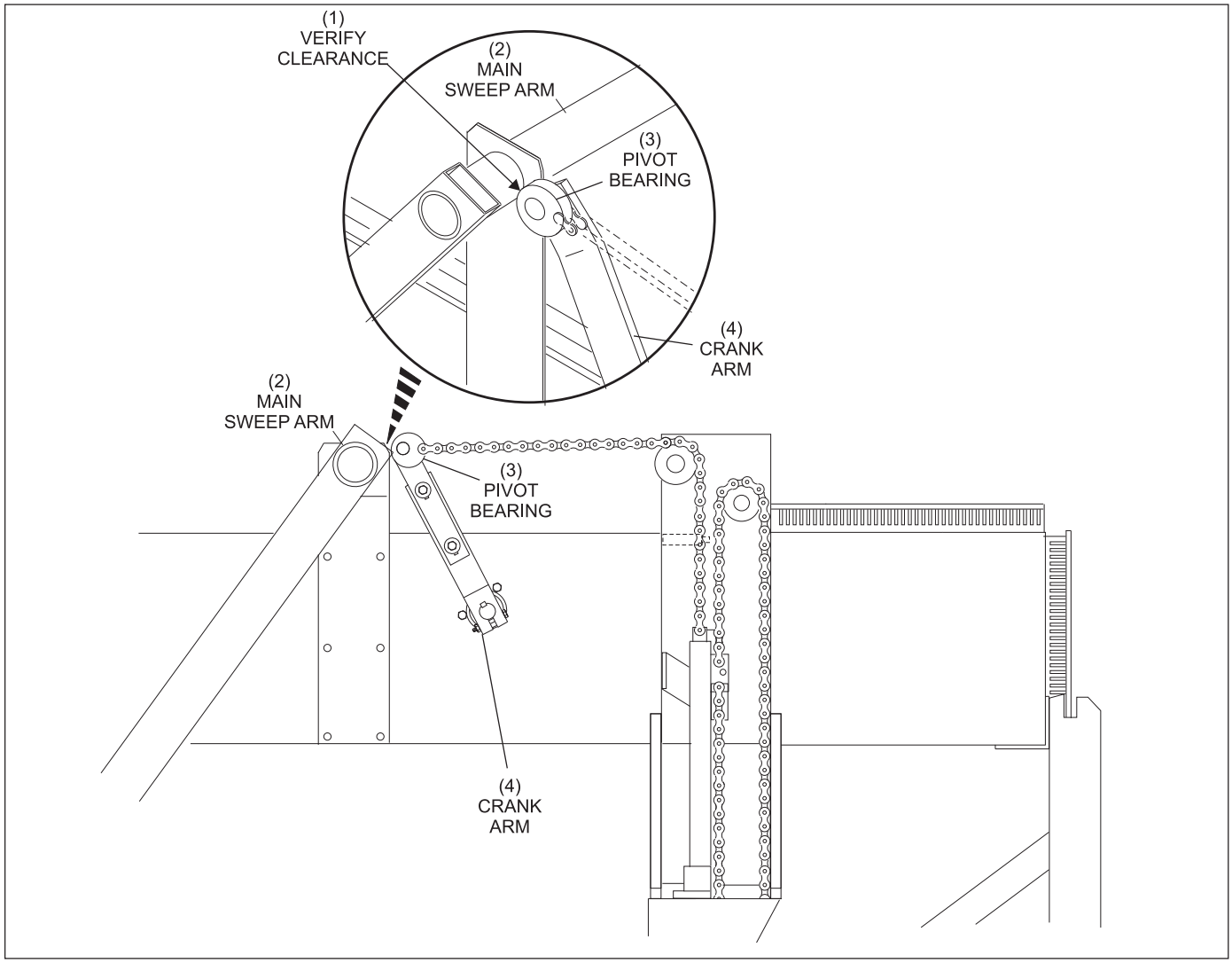


Figure 5-36. Check Pivot Bearing Clearance

(1) VERIFY CLEARANCE (2) MAIN SWEEP ARM (3) PIVOT BEARING
(4) CRANK ARM

Below are some of the possible problems that can occur if the setting table is not at the proper heights in the Highest and Lowest positions.

Pin Deck Position

Setting Table Too Close To Pin Deck	1. Setting table makes contact with lane surface. 2. Pins wobble when set on lane.
Setting Table Too Far From Pin Deck	1. Weight of pin will not allow grippers to open to release pins to the lane.

Distributor Position

Table Too Far From Distributor	1. Pin grippers may not make proper contact with the pin release levers to allow pins to enter the pin holder. 2. Pins may not drop into the pin holders properly, resulting in pin jams.
Table Too Close To Distributor	1. Number 3 swing shaft may make contact with right-hand tower support. 2. Setting table may hit distributor. 3. Damage to the pinstation or pin slider. Pinstation release levers fall off.

Pin Position Adjustment

This adjustment will be necessary when pins are not being set on spot per USBC or FIQ requirements.

a. Push the "SET" switch on the Nexgen Controller box. As the table lowers to set new pins, shut off the pinsetter when the grippers open to leave the pins on the lane.

b. Check the position of all ten bowling pins in relation to their pin spots. Determine which pins are off spot and adjust as follows.

(1) FRONT OF PIN
(2) PIN SPOT
(3) PIN DECK

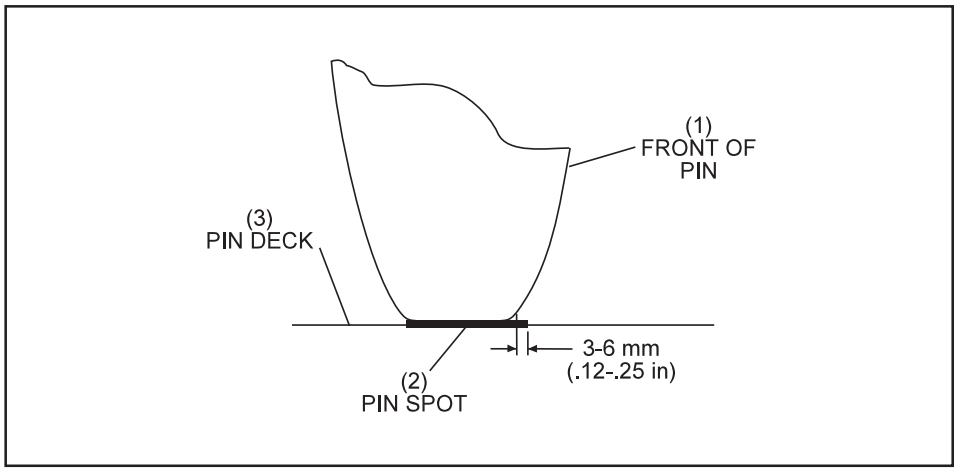


Figure 5-37. Proper Pin Position.

Side to Side

1. To adjust individual pins left or right, loosen the four pin holder fastening bolts. See *Figure 5-38.*

2. Adjust the pin holder as needed,.

3. Retighten the four bolts.

NOTE: *Check the clearance between the pin detector plates and the pin holders in front of them after making any side to side adjustments.*

(1) BOTTOM VIEW OF PIN HOLDER (WITH PIN DETECTOR PLATE REMOVED)
(2) FASTENING BOLT

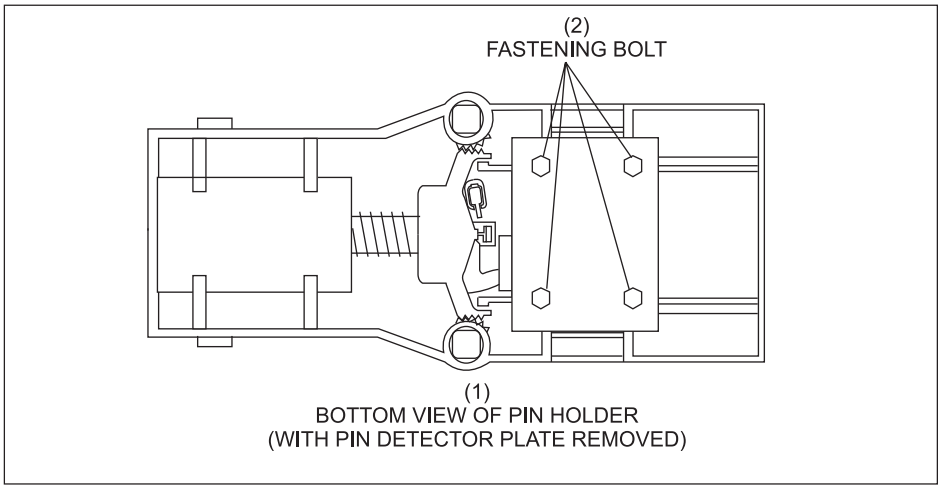


Figure 5-38. Pin Holder Fastening Bolts.

Forward/Backward

NOTE: *The ten pin holders can be adjusted by rows or group of rows.*

1. To adjust all ten pin holders forward or backward, loosen the jam nut on the vertical stop bolt mounted on the rear right swing shaft. Refer to *Figure 5-39*. This bolt stops the vertical rotation of the rear pin holder swing shaft when the table goes down for a new pin setting stroke.

NOTE: *Shortening the bolt will allow all ten pins to be moved backward. Lengthening the bolt will move all pins forward.*

(1) VERTICAL STOP BOLT

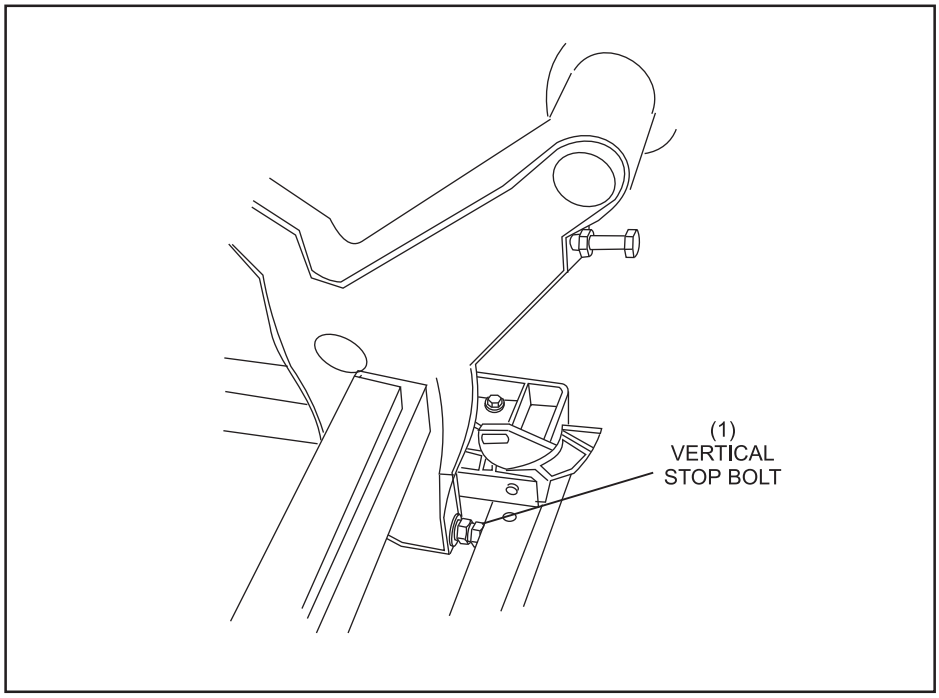


Figure 5-39. Adjust Pin Holders.

Adjusting a row of pins is performed by adjusting either the vertical stop bolt (for the 7-8-9-10 pin row) as described above, or the swing arm interlink bolt located directly behind the desired row.

2. To adjust a swing arm position, loosen the swing arm interlink bolt from the arm. See *Figure 5-40*.

3. Move the interlink bolt and cam up or down as desired.

NOTE: *Moving the bolt and cam up will direct the base of the pins forward while moving the bolt down will move the pin base backward. The pins on any row forward of the adjustment will be impacted.*

NOTE: *After adjusting the desired row, you may need to reposition the pin holders for rows forward of the adjusted row using the appropriate swing arm(s).*

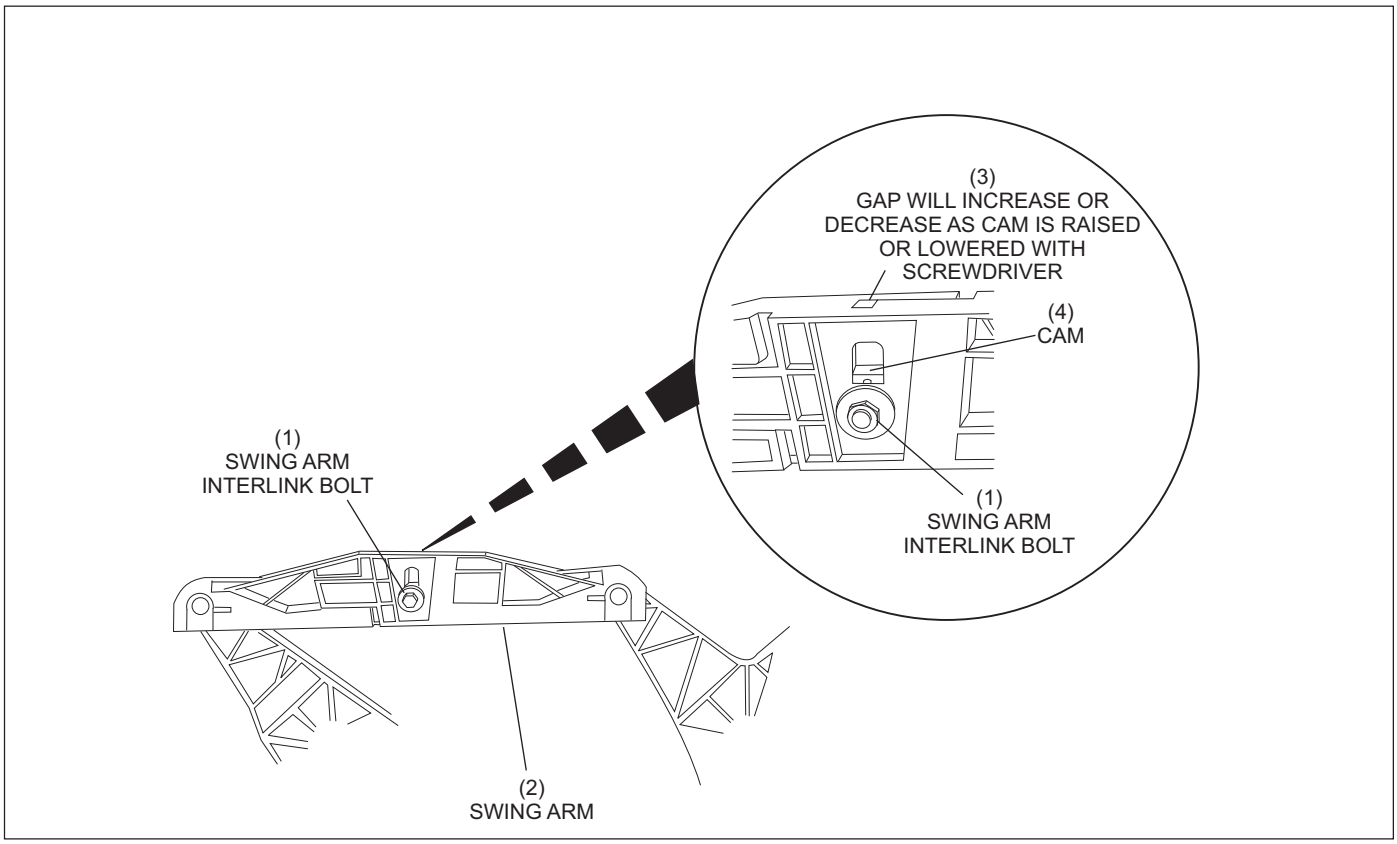


Figure 5-40. Swing Arm Adjustment.

(1) SWING ARM INTERLINK BOLT

(2) SWING ARM

(3) GAP WILL INCREASE OR DECREASE AS CAM IS RAISED OR LOWERED WITH SCREWDRIVER

(4) CAM

Pin Detection Height Adjustment

This adjustment positions the stroke limiter plate assembly so that the table lowers far enough to detect standing pins but not so far that the pin detector plates are jammed into the pinholders. When adjusted properly, there should be 3-5 mm clearence between the pin detector plate and the pinholder when the weight of the table is fully supported by the stroke limiter. Before making any adjustment verify that the stroke limiter shock absorber is in good shape and the table is level.

a. Set 10 pins on spot on the lane surface.

b. Lower the setting table so its weight is fully resting on the stroke limiter plate and the stroke limiter's hydraulic shock absorber is fully compressed.

c. With the pin detector plate held up manually to the highest point, check for a clearance of 5 mm between the top of the pin and the center of the pin detector plate. Refer to *Figure 5-41*.

(1) PINHOLDER
(2) DETECTORPLATE

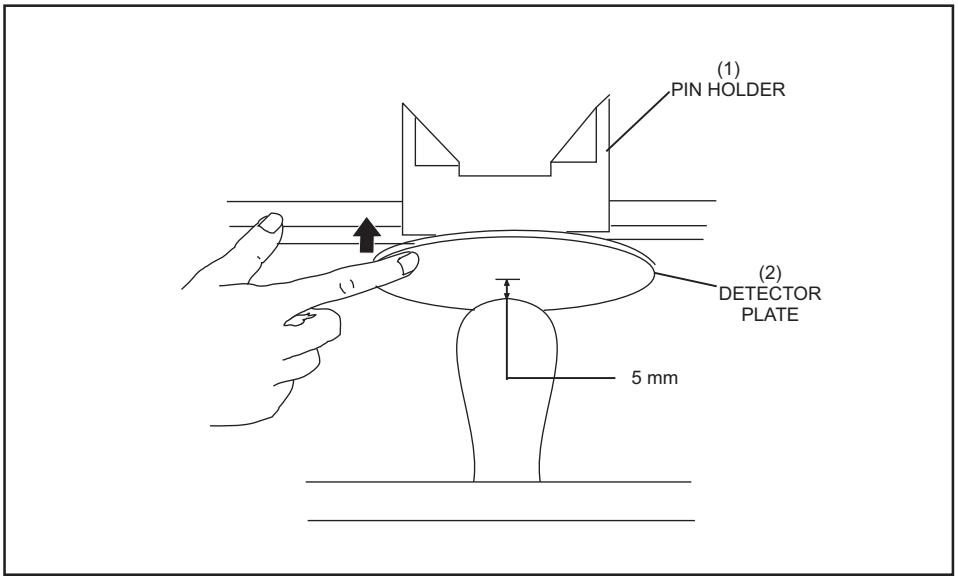


Figure 5-41. Pin Detector Plate Clearance.

e. If an adjustment is required, raise the table off the stroke limiter. Loosen the locknuts on the stroke limiter mounting bracket's vertical bolt and loosen the two mounting bolts illustrated in *Figure 5-42*. Lower or raise the stroke limiter as needed. Repeat steps a - d until the 3 - 5 mm clearance is obtained.

(1) LOOSEN MOUNTING BOLTS
(2) LOOSEN LOCKNUT
(3) ADJUSTMENT BOLT
(4) SHOCK STOP COLLARS

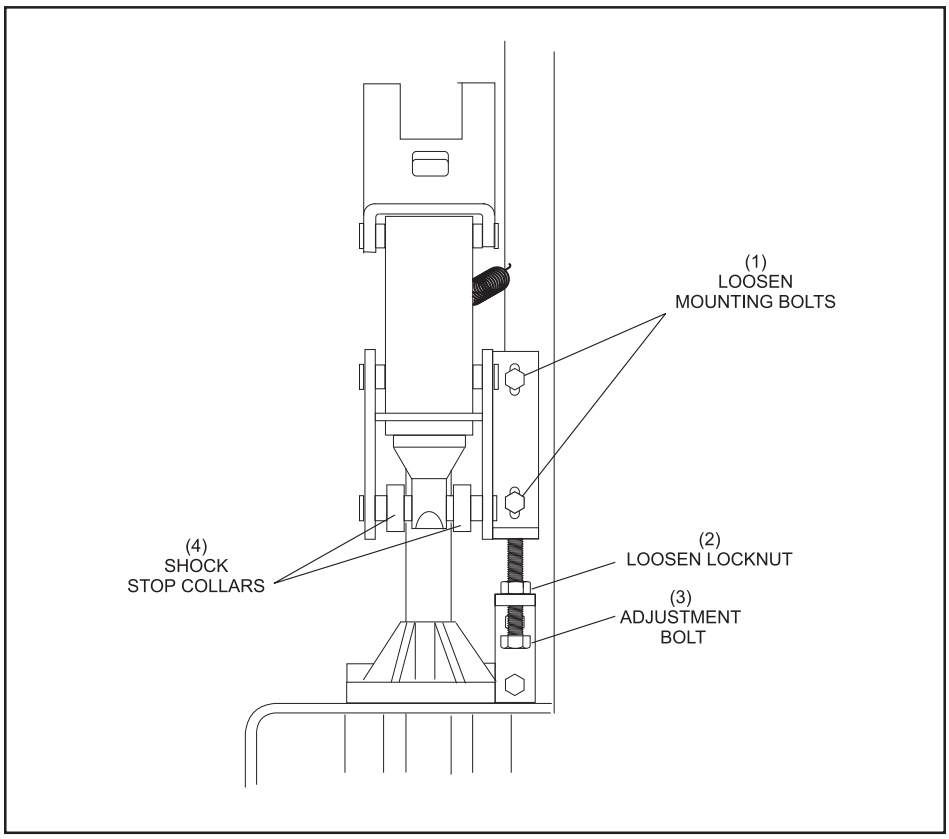


Figure 5-42. Adjusting Stroke Limiter Mounting Bracket.

Stroke Limiter Plate Adjustment

a. Manually lower the setting table until the stroke limiter "T" stop **lightly touches** the stroke limiter plate.

b. Manually push in the plunger of the stroke limiter solenoid. Check for a clearance of 5 mm $\pm$ 1 mm between the "T" stop and the stroke limiter plate. Refer to *Figure 5-43* and *5-44*. To adjust, loosen both solenoid mounting screws and hold the plunger so its bottomed in the solenoid . Reposition the solenoid to achieve a 5 mm clearance. Retighten the mounting screws.

(1) STROKE LIMITER PLATE

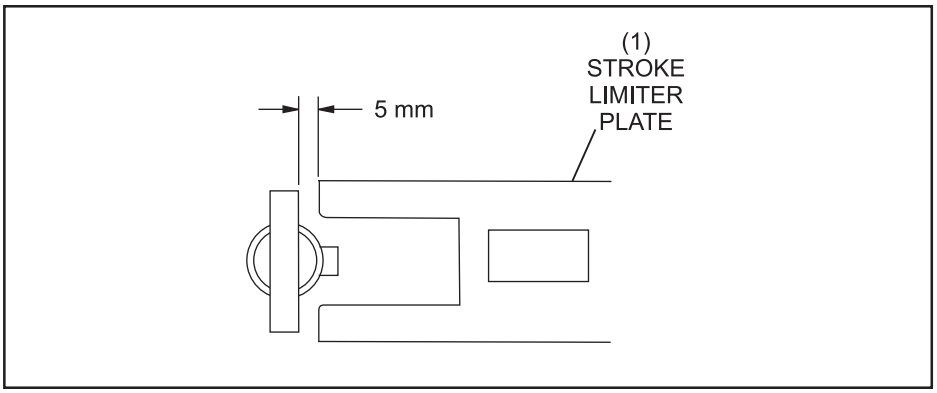


Figure 5-43. Stroke Limiter Clearance.

(1) LEFT-HAND SQUARE SHAFT
(2) STROKE LIMITER PLATE
(3) T-STOP
(4) LEFT-HAND TABLE TUBE
(5) STROKE LIMITER SOLENOID
(6) STROKE LIMITER SHOCK ABSORBER

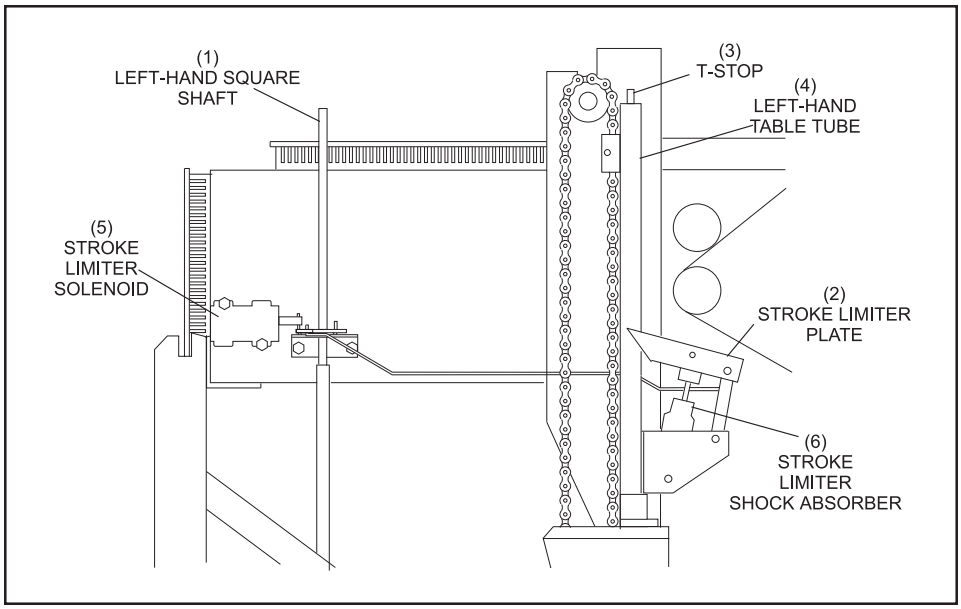


Figure 5-44. Stroke Limiter Adjustment.

d. With the stroke limiter plate forward in its normal position, check that the plate is centered on the "T" stop. If not, adjust the stroke limiter plate mounting bolt and center the hydraulic shock on its lower mounting shaft by loosening the set collars and moving the hydraulic left or right. Refer to *Figures 5-43*.

TS1 Actuator Arm Adjustment

The TS1 Actuator arm must be positioned correctly to allow for a smooth transition when the pinholders are released to their vertical position and to ensure that the TS1 switch is actuated quickly should there be a problem with the holders returning horizontal. When the table is at home position ("A" Switch) the arm should push upward approximately 20 mm, and be located squarely on the table roller. Refer to *Figure 5-45.*

(1) TS-1 SWITCH
(2) PIN HOLDER
(3) REAR SWING SHAFT
(4) ROLLER
(5) ACTUATOR ARM
(6) ADJUSTMENT BOLTS

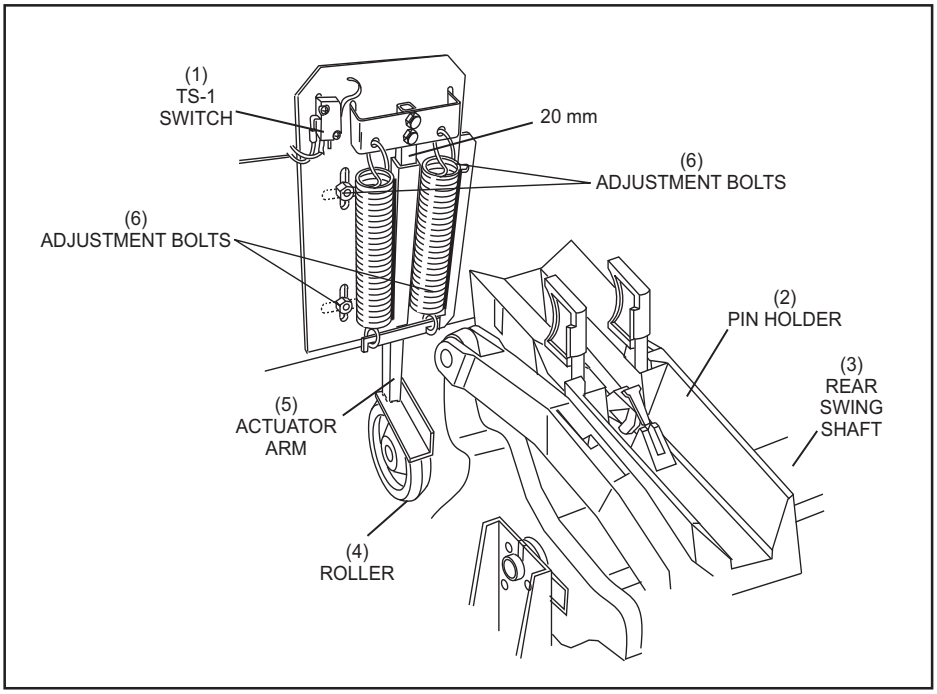


Figure 5-45. TS1 Actuator Arm Adjustment

Pin Holder Swing Shaft's Latch Hook/Horizontal Stop Bolt Adjustment

The latch hook holds the pin holders in the horizontal position for pin detection and pin loading. When the latch is released, the pin holders are allowed to rotate vertically to set "new" pins. This adjustment ensures that the table swing shafts travels far enough horizontally so that the latch can "catch" the latch bow and will move freely when the stroke limiter solenoid is energized.

a. Raise the setting table to its highest position.

b. Check for a gap of 3 mm between the rear swing shaft's latch bow and the latch hook. Adjust the horizontal stop bolt on the rear swing shaft to obtain the 3 mm gap. Refer to *Figure 5-46 & 5-47*.

(1) 3 MM GAP
(2) LATCH BOW
(3) LEFT-HAND SQUARE SHAFT
(4) LATCH HOOK

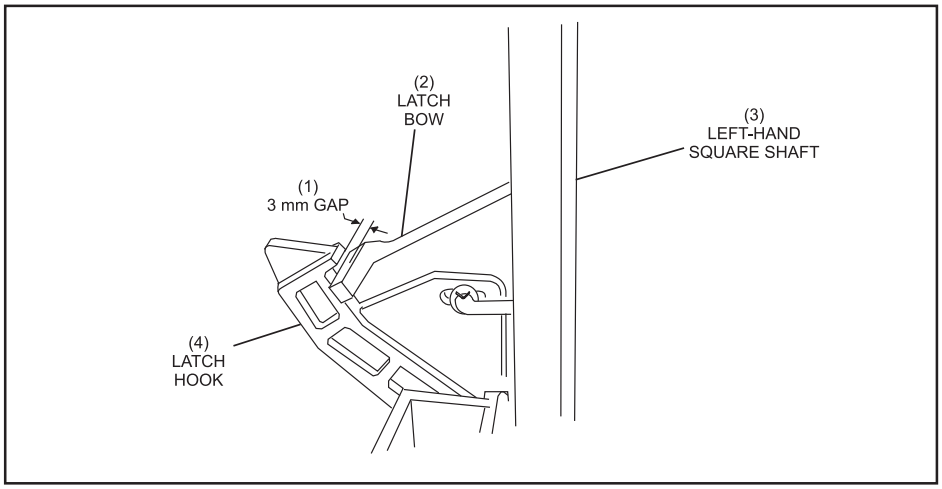


Figure 5-46. Rear Swing Shaft's Latch Bow and Latch Hook.

(1) HORIZONTAL STOP BOLT

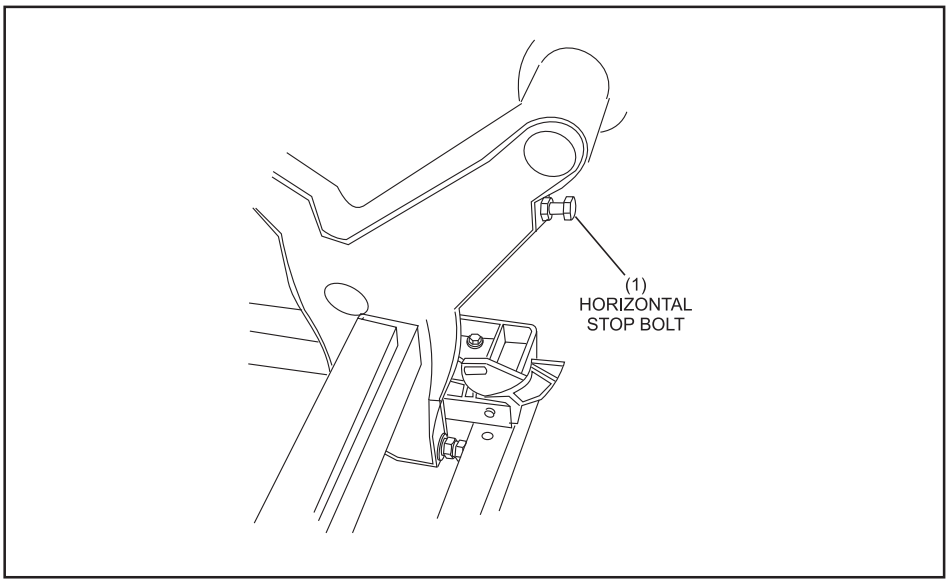


Figure 5-47. Adjusting Horizontal Stop Bolt.

Spotting Tong Drive Adjustment

The spotting tongs are driven closed and open through a clutch and gear assembly. Refer to *Figure 5-48.*

(1) SPINDLE SHAFT
(2) 3 NOTCHES USED FOR ADJUSTING
(3) SAFETY CLUTCH

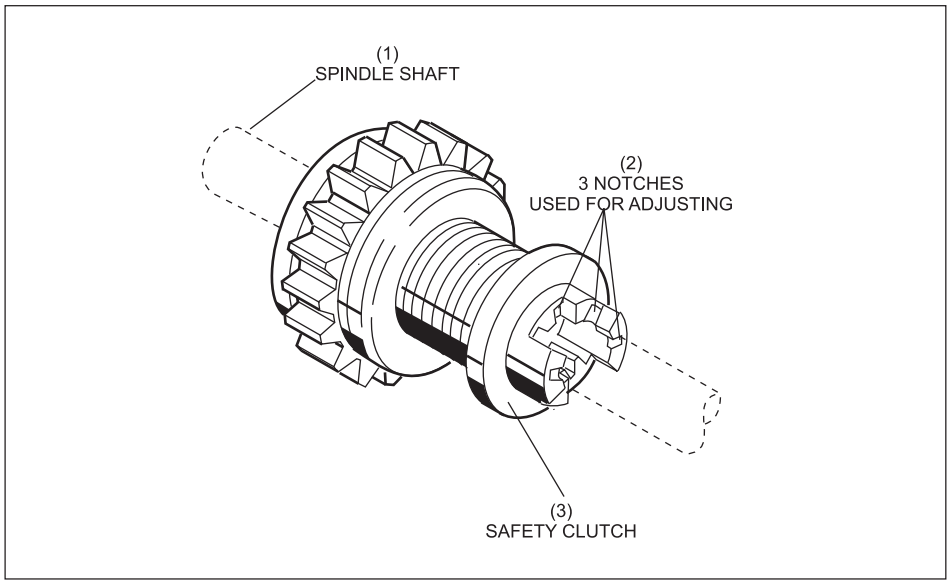


Figure 5-48. Spotting Tong Spindle Shaft Clutch.

Two adjustable stops on the ends of setting table's main spotting tong tooth rack stop the closing and reopening of the tongs causing the spotting tong clutch to slip. The clutch has 3 tension setting to provide compesate for clutch wear and ensure proper torque on the drive shaft. The normal position for the tension setting is the either the first or middle notch.
If the table drops pins during a standing pin cycle verify that there is sufficient spring tension in the clutch, the stops are adjusted properly and the damper inserts in the tongs are not worn. . Refer to *Figure 5-49.*

(1)OPEN STOP
(2) GEAR RACK
(3) SPOTTING TONG SWITCH
(4) RIGHT-HAND SQUARE SHAFT
(5) CLOSED STOP

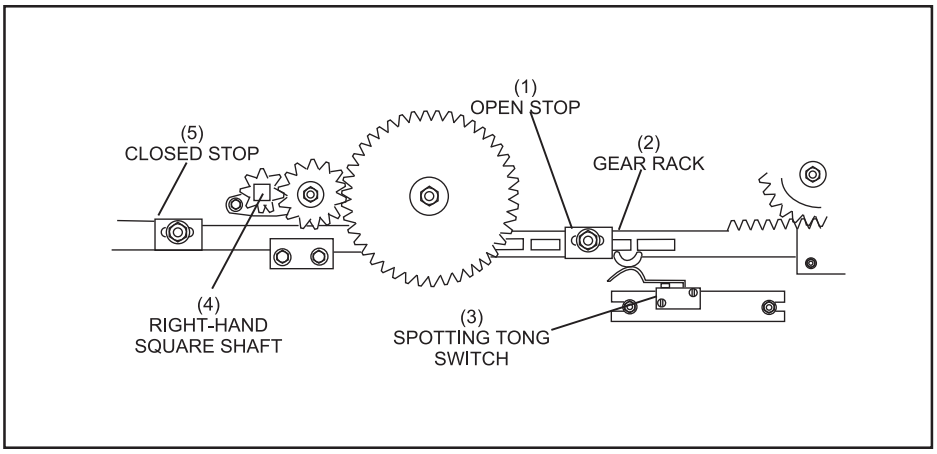


Figure 5-49. Adjustable Stops on Setting Table Tong Rack.

Sweep Attenuator / Switch "G" Adjustment

a. The attenuator rests against a stop bolt when the sweep is all the way down in the guarding position. Adjust the length of this screw to 85 mm ± 1 mm between the frame and the front of the attenuator. The should result in the attenuator being parallel with front mounting plate. Refer to *Figure 5-50.*

(1) SWITCH "G"
(2) FRONT MOUNTING PLATE
(3) STOP SCREW
(4) HEX NUTS
(5) SWEEP ATTENUATOR
(6) PLUNGER FREE PLAY WITH SWITCH CLOSED

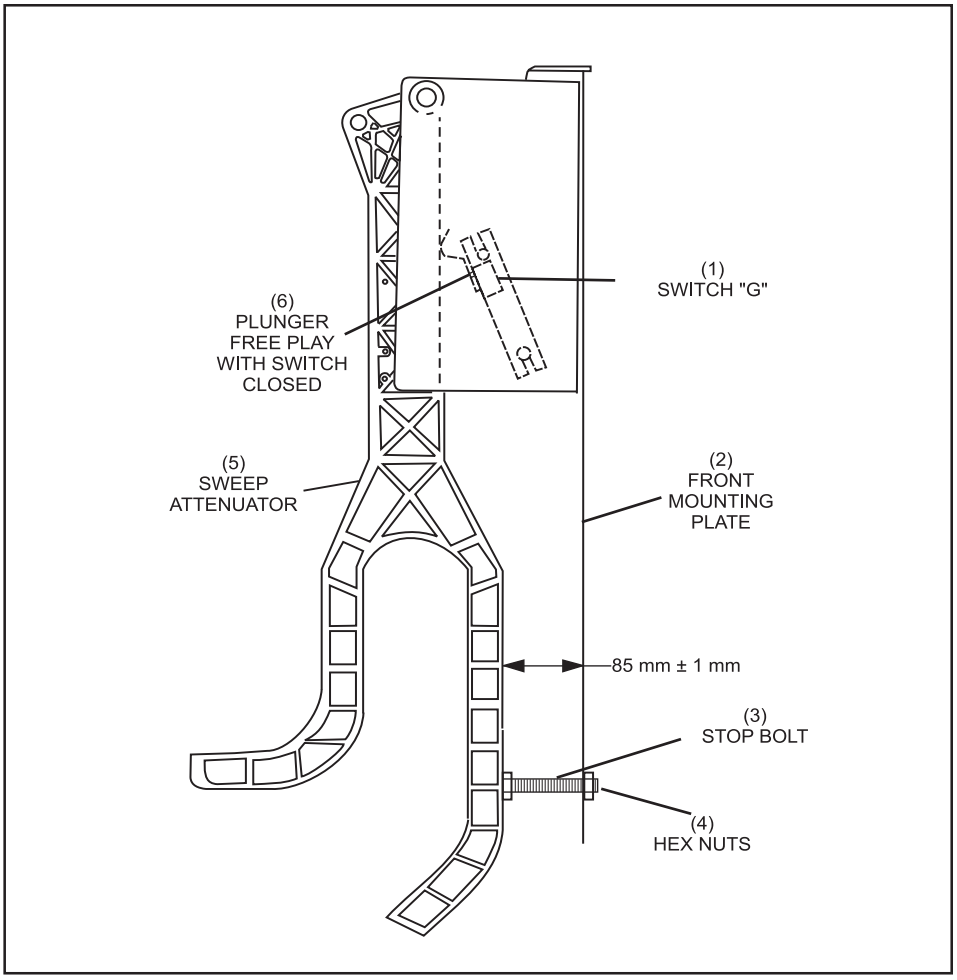


Figure 5-50. Sweep Attenuator/Switch "G" Adjustment.

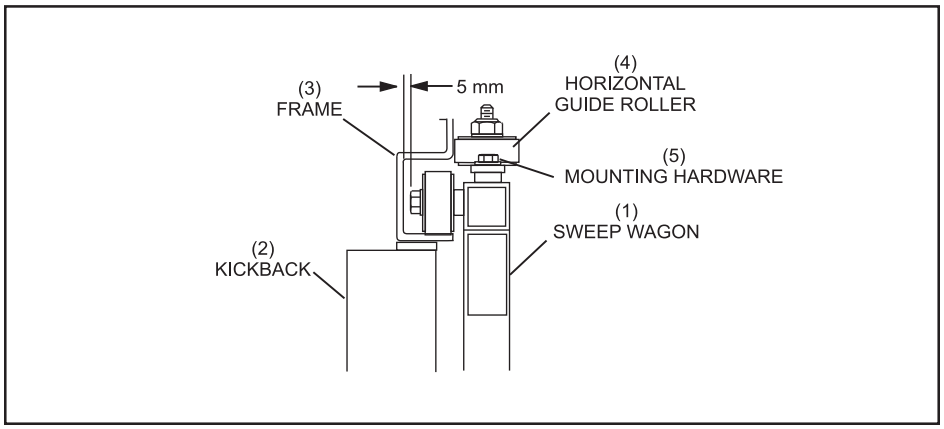
b. Adjust the "G" switch with the attenuator down. The switch's plunger must have free play with the switch closed. Refer to *Figure 5-50.*

NOTE: *If free play in the plunger cannot be attained by moving the switch, increase the 85 mm dimension 1 mm at a time until there is free play with the switch closed.*

Sweep Wagon Roller Adjustment

The sweep wagon rides on guide rollers that travel in two guide rails on the pinsetter frame. The horizontal rollers must be adjusted so the mounting bolts of the vertical rollers have a minimum clearance of 5 mm from the inside wall of the side frame and each vertical roller is fully resting on the rails. To adjust, loosen the mounting hardware for the horizontal guide rollers and position the sweep side to side. Refer to *Figure 5-51*.

NOTE: *Check the sweep wagon in the forward and rearward position for clearance.*



(1) SWEEP WAGON
(2) KICKBACK
(3) FRAME
(4) HORIZONTAL GUIDE ROLLER
(5) MOUNTING HARDWARE

Figure 5-51. Sweep Wagon Roller Adjustment.

Sweep Board Height Adjustment

The sweep board is held in the raised position by the sweep release assembly. The sweep release assembly is connected to the table drive gear via a lift chain and pivot bearing. When properly adjusted the sweep board should be hidden from the bowler's view when they are at the foul line. To adjust the height, position the chain link pin in a different hole attaching the lift to the pivot bearing, as needed. Make sure that the sweep baord has sufficient clearence from the pinsetter frame when it is in it up position. A 50 mm ±1 mm distance is recommended. Refer to *Figures 5-52* and *5-53.*

(1) PIVOT BEARING
(2) SETTING TABLE GEAR
(3) SWEEP RELEASE CHAIN

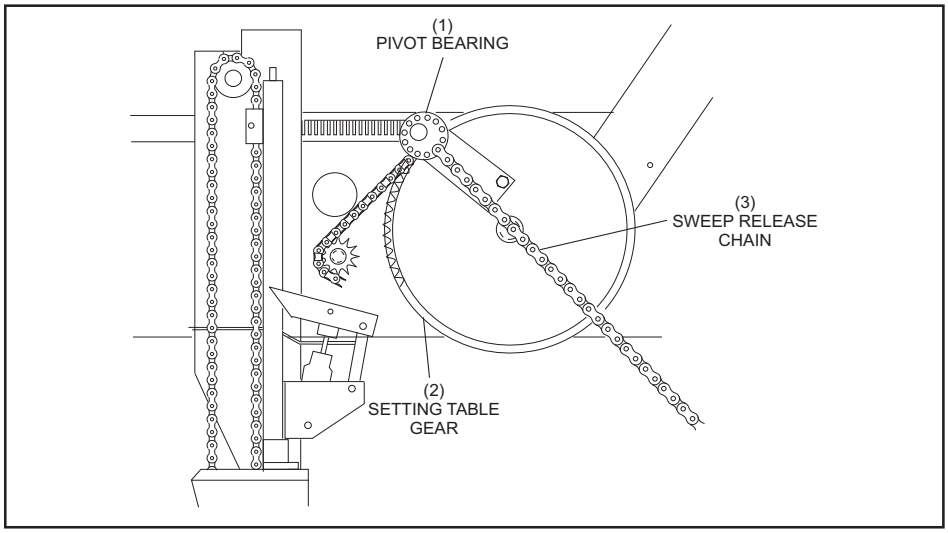


Figure 5-52. Sweep Board Height Adjustment.

(1) HOLE 1
(2) HOLE 2
(3) HOLE 3
(4) HOLE 4
(5) HOLE 5
(6) HOLE 6
(7) HOLE 7

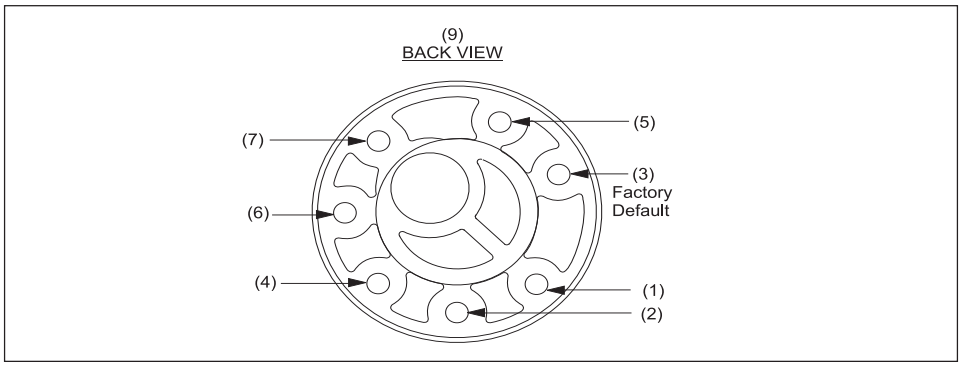


Figure 5-53. Sweep Board Pivot Bearing

Curent Hole	Move to Hole						
	1	2	3	4	5	6	7
1	NC	S2	S4.9	S7.5	S11.4	S14.4	S18
2	L2	NC	S2.9	S5.5	S9.4	S12.4	S16
3	L4.9	L2.9	NC	S2.6	S6.5	S9.54	S13.1
4	L7.5	L5.5	L2.6	NC	S3.9	S6.9	S10.5
5	L11.4	L9.4	L6.5	L3.9	NC	S3	S6.6
6	L14.4	L12.4	L9.5	L6.9	L3	NC	S3.6
7	L18	L16	L13.1	L10.5	L6.6	L3.6	NC

Chain Adjustment Length Matrix.

NOTE: *L = Lengthen, S = Shorten, NC = No Change.*
All numbers are in millimeters. Example: Moving from hole 1 to hole 2 S2 = Shortens the chain 2 mm.

Sweep Board Gutter Adapter Adjustment

With the sweep board down and fully forward, adjust the gutter adapter to obtain a maximum of 5 mm clearance between the adapter and the gutter. Refer to *Figure 5-54*.

(1) ADJUST ELEVATION USING THESE SCREWS
(2) SWEEP BOARD
(3) GUTTER
(4) GUTTER ADAPTER

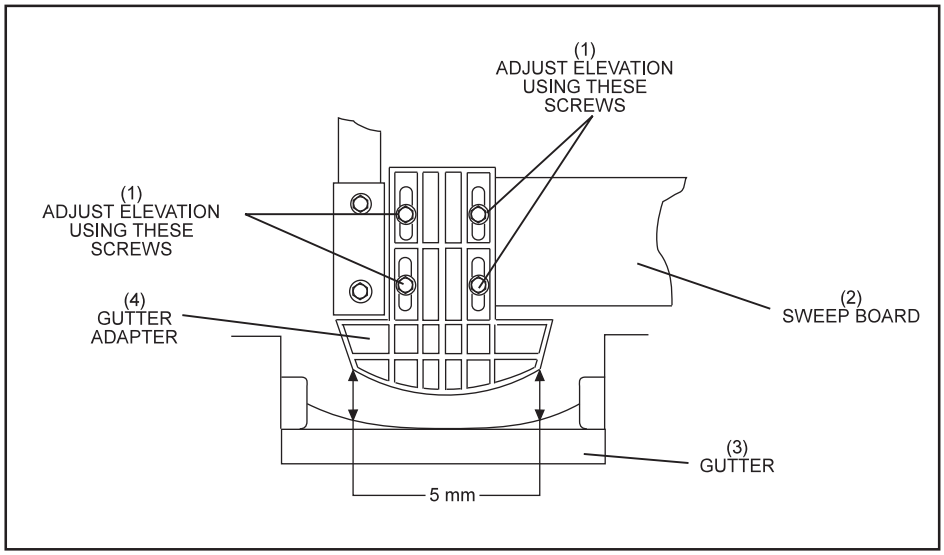


Figure 5-54. Sweep Board Gutter Adapter Adjustment.

Distributor Drive Belt Adjustment

The two distributor V-belts may need occasional adjustment. When replacing these V-belts, they should be done in pairs with both belts being as close to the same length as possible.

To adjust, loosen the two bolts on the side tensioning plate. Tighten or loosen the adjusting screw to obtain 10-15 mm of free play in both belts. Refer to *Figure 5-55*.

(1) LOOSEN BOLTS BEFORE ADJUSTING
(2) DISTRIBUTOR V-BELTS 10-15 MM FREE PLAY
(3) ADJUSTING SCREW

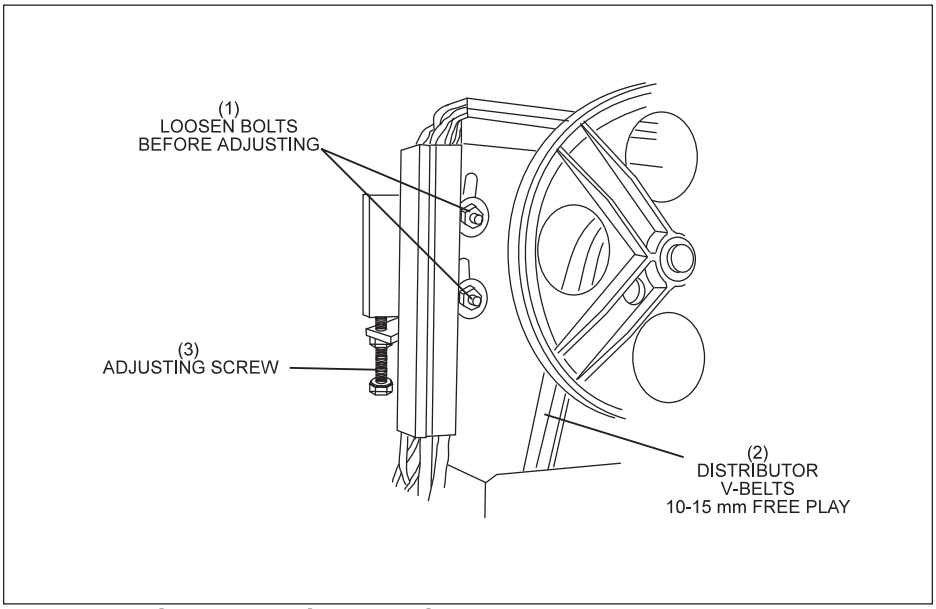


Figure 5-55. Adjusting Distributor V-Belts.

Drive Motors

The tension of the sweep and table motor chains should be set for 5-8 mm of free play. Refer to *Figure 5-56*.

To adjust, loosen the four bolts mounting the bearing plate to the left drive frame. Move the plate using the chain tiension adjuster until the desired amount of free play is obtained. Retighten mounting bolts. Refer to *Figure 5-57*.

CAUTION: If the chains are stretched too tight, the shaft bearings may be strained. If they are too loose, they may slip off and cause damage to the pinsetter or the person servicing the machine.

(1) 5-8 MM TOTAL FREE PLAY

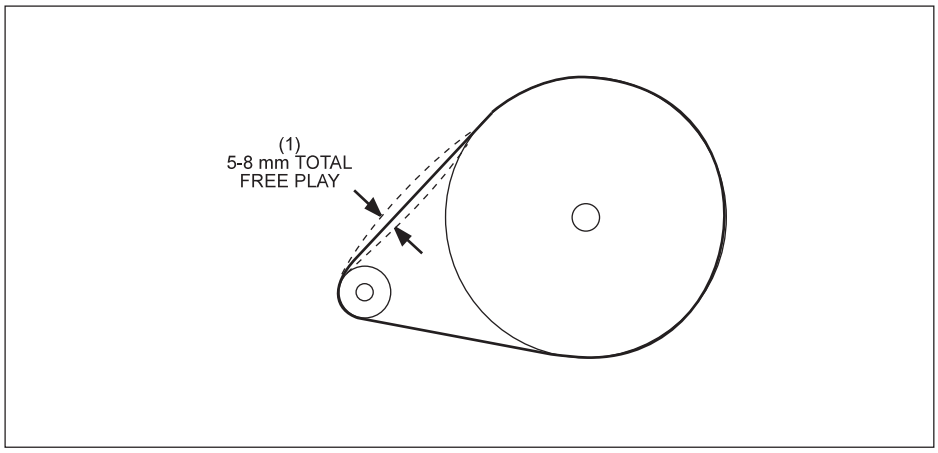


Figure 5-56. Sweep and Table Motor Chain Free Play.

(1) FOUR SWEEP GEAR SCREWS
(2) FOUR TABLE GEAR SCREWS

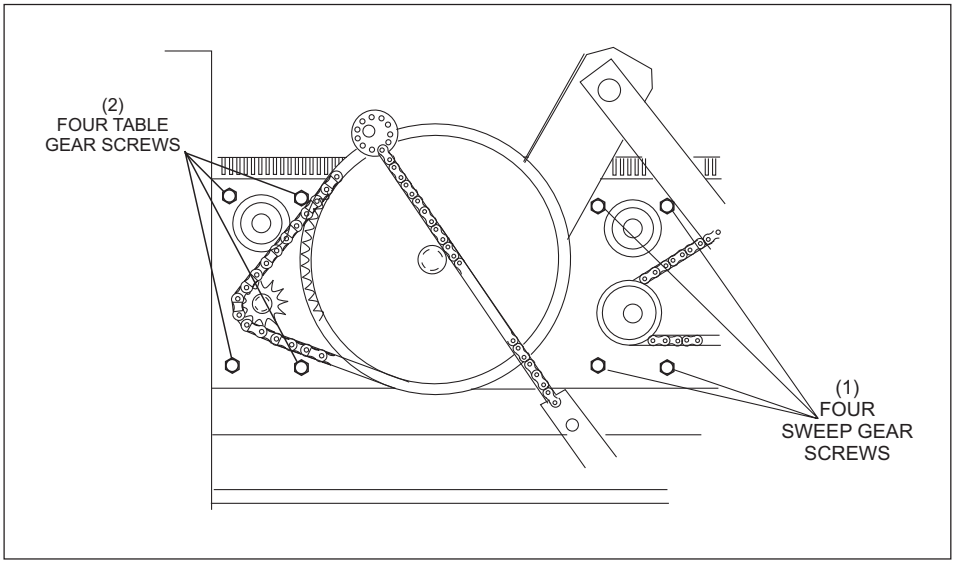


Figure 5-57. Adjust Reduction Gear

(1) BEARING PLATE
(2) TABLE OR SWEEP SHAFT
(3) MANUALLY ADJUST BEARING PLATE
(4) CHAIN TENSION ADJUST

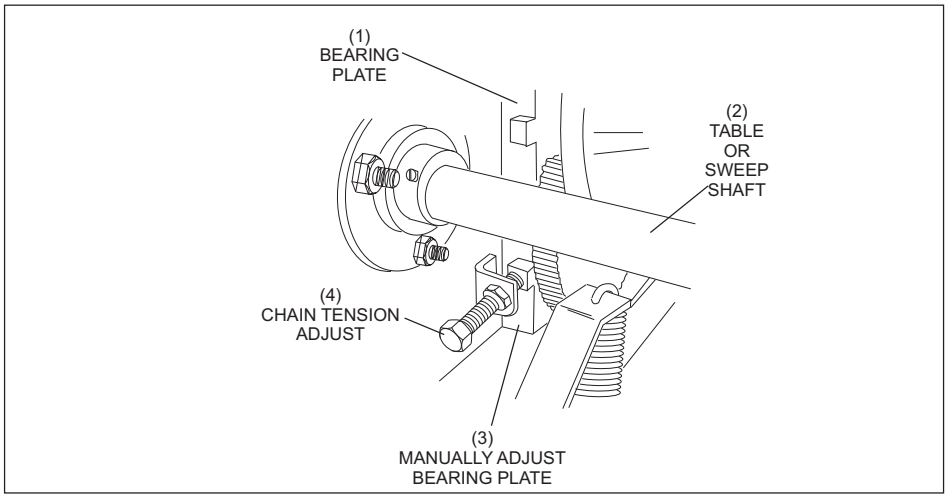


Figure 5-58. Chain Tension Adjuster.

Elevator

The two parallel elevator chains may need occasional adjustment to remove excessive free play due to the chain stretching.

To adjust, loosen the two bolts on both tensioning plates on the sides of the elevator and the jam nut on the tensioning bolt. Tighten or loosen the adjusting bolts to obtain minimal free play in both chains.

NOTE: *The adjusting screws should be rotated the same amount to eliminate the possibility of chain damage or binding and to keep the pin shovels level.*

(1) ELEVATOR
(2) SIDE TENSION PLATE
(3) ADJUSTMENT SCREW

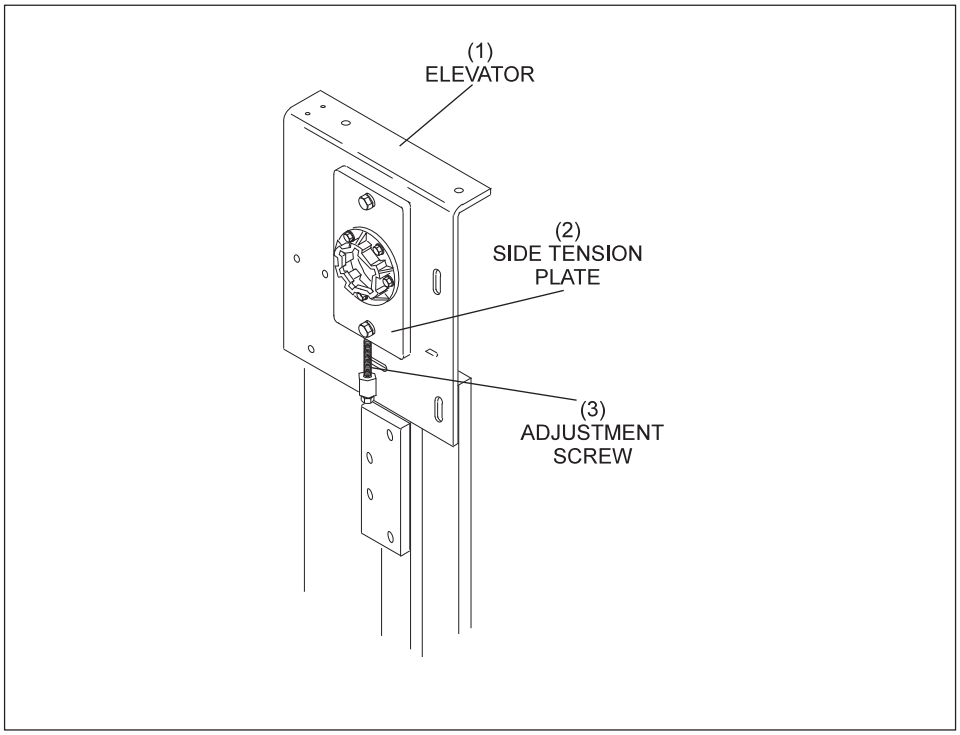


Figure 5-59. Elevator Chains.

Gear Adjustment - General

All gears ***must*** have a tooth gap. If gears are set too loose, they may slip and/or break. If they are set too tight, jams and breakage and exessive wear may occur. Refer to *Figure 5-60*.

(1) TEETH SHOULD NOT BE FULLY SEATED

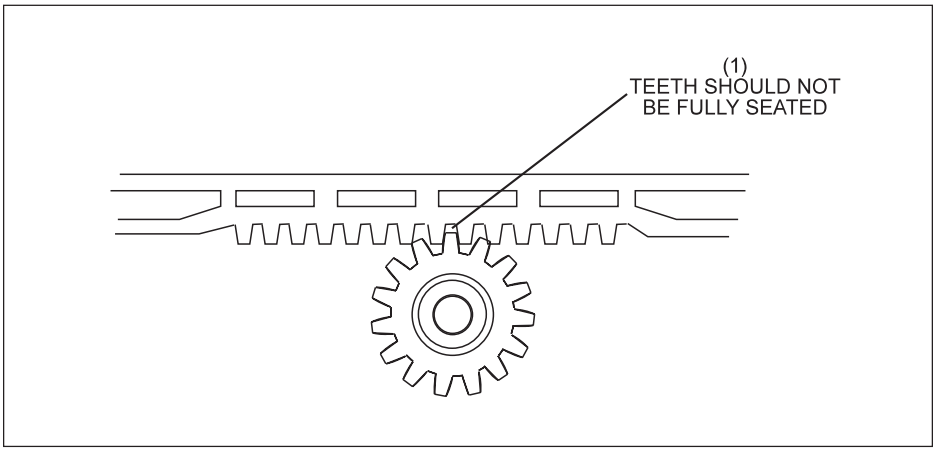


Figure 5-60. Adjusting for Proper Tooth Gap.

NOTE: *When adjusting for proper tooth gap, it is important to check the entire travel area. It is possible to have a gear rack properly adjusted in one area and be too loose or too tight in another area of travel.*

Switch Adjustment - General

Table position switches “B”, “C” and “D” on the switch cluster are adjusted for a gap of 3 mm between the switch and the magnet on the switch cam. Refer to *Figure 5-61*.

(1) SWITCHES B, C & D 3 MM GAP
(2) SWITCH
(3) ACTUATOR ARM MAGNET

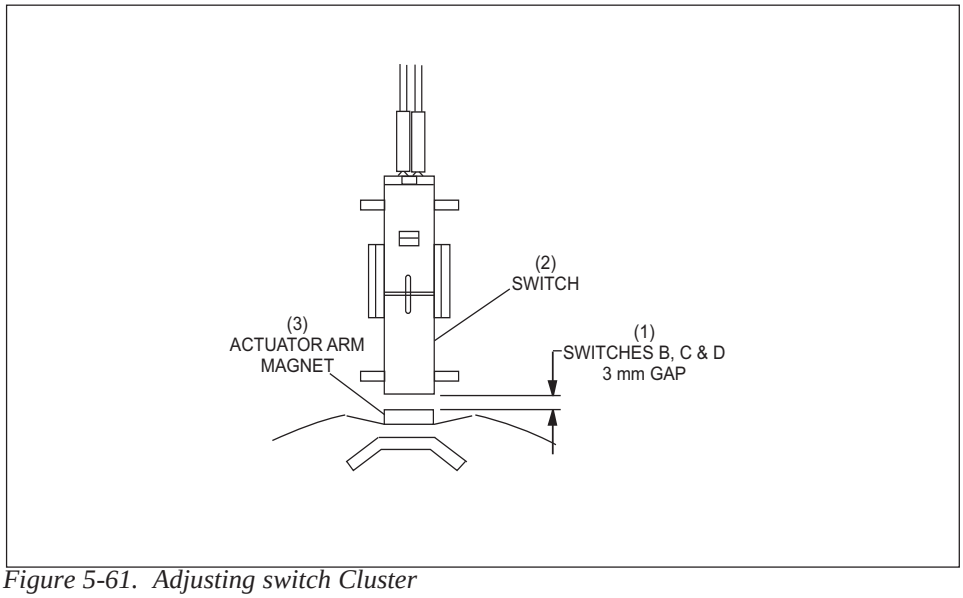


Figure 5-61. Adjusting switch Cluster

The “A” switch is adjusted to be contacted by the switch cam’s actuator when the table is in its highest position. Refer to *Figure 5-62*. For further information on adjusting the “A” switch, refer to Switch Cluster Timing adjustment in this manual.

(1) SWITCH A IS ADJUSTED TO CONTACT CAM WHEN SETTING TABLE IS IN HIGHEST POSITION

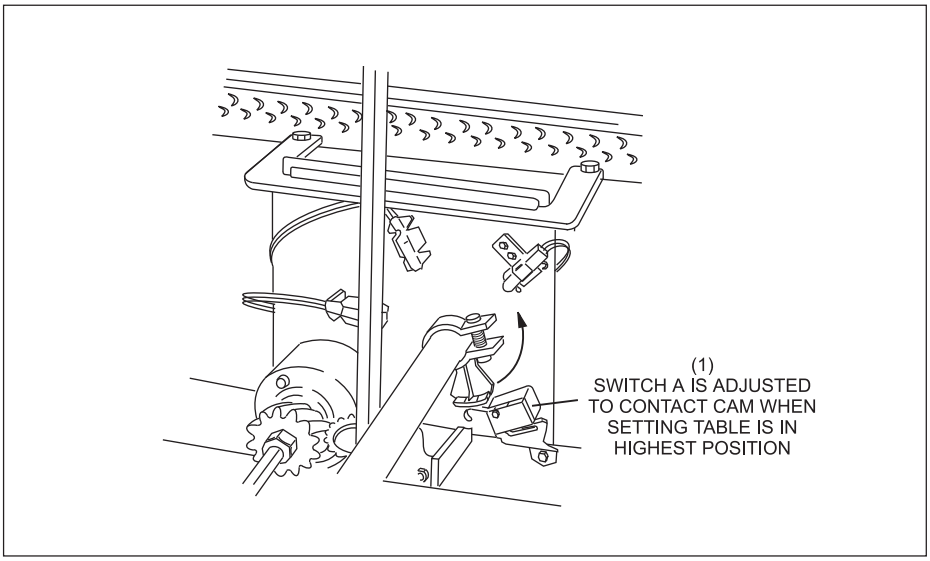


Figure 5-62. Adjusting Switch "A."

Function switches, such as the Spotting Tong switch illustrated in *Figure 5-63*, are to be adjusted as shown in View A. Views B and C illustrate being adjusted too far away and too close for proper operation.

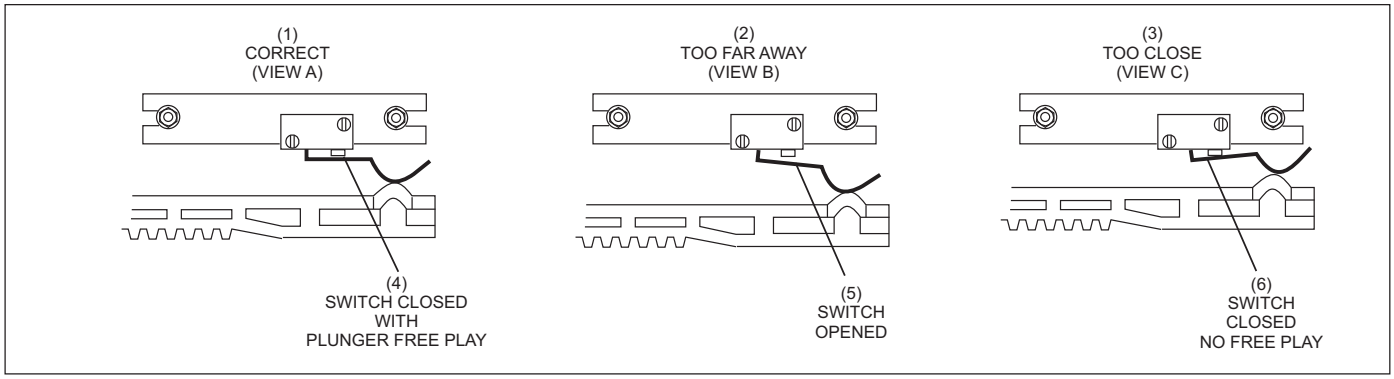


Figure 5-63. Spotting Tong Switches.

(1) CORRECT (VIEW A)
(2) TOO FAR AWAY (VIEW B)
(3) TOO CLOSE (VIEW C)
(4) SWITCH CLOSED WITH PLUNGER FREE PLAY
(5) SWITCH OPENED
(6) SWITCH CLOSED NO FREE PLAY

When a switch is adjusted correctly, some free play should be available on the actuating switch plunger when the switch is closed.

Contents

Bowling in Progress 6-3

Pinsetter Clearing Procedure After Stop 6-3

Cable Repair 6-7

Error Code Description and Causes 6-8

Problem/Cause/Corrective Action 6-13

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Section 6: Troubleshooting

Bowling in Progress

The following information and procedures should be used for correcting pinsetter stops, or malfunctions. Follow safety guidelines in the Servicing section.

When a pinsetter experiences a stop, the Pinsetter CPU, will shut down the pinsetter, and flash the red status light located on top of the elevator assembly. Typically a code indicating the problem encountered will display on top of the Nexgen box or on the mechanic's remote display if installed.

Pinsetter Clearing Procedure After Stop

When a pinsetter experiences a stop, the Pinsetter CPU, will shut down the pinsetter, and flash red status light located on top of the elevator assembly. Typically a code indicating the problem encountered will display on top of the Nexgen box or on the mechanic's remote display if installed. Refer to *Figure 6-1*

NOTE: *Some errors or problems with the pinsetter may not be detected by the Pinsetter CPU. Examples are ball accelerator problems or scoring errors. In these situations the status light will not flash to indicate a problem.*

The following procedure should be used for correcting pinsetter stops or malfunctions.

1. When approaching the pinsetter from the rear, turn the stop/run switch located on the mechanic's control or the remote display terminal to the stop position. When approaching the pinsetter from the front, turn the stop/run switch on top of the Nexgen Controller to the stop position.

2. Determine the reason for the stop. Look for pins on shark switch assembly, distributor or on top or the setting table. If the trouble light is flashing look at the display located on the top of the Nexgen Controller or on the remote display terminal for an associated error code.

3. Clear the jam, repair or replace the failed part, or make the adjustment as appropriate. If making the correction requires work to be done on the pindeck, ball accelerator, or pit area, lower the sweep wagon to prevent a ball from entering the machine(s).

4. Reinstall all guards.

5. Set the STOP/RUN switch to the run position.

6. If the machine will not restart, recheck the error code diagnostic display. If an invalid state is displayed, you must return the table (up) or sweep (forward) to its home position.

(1) DIAGNOSTIC DISPLAY

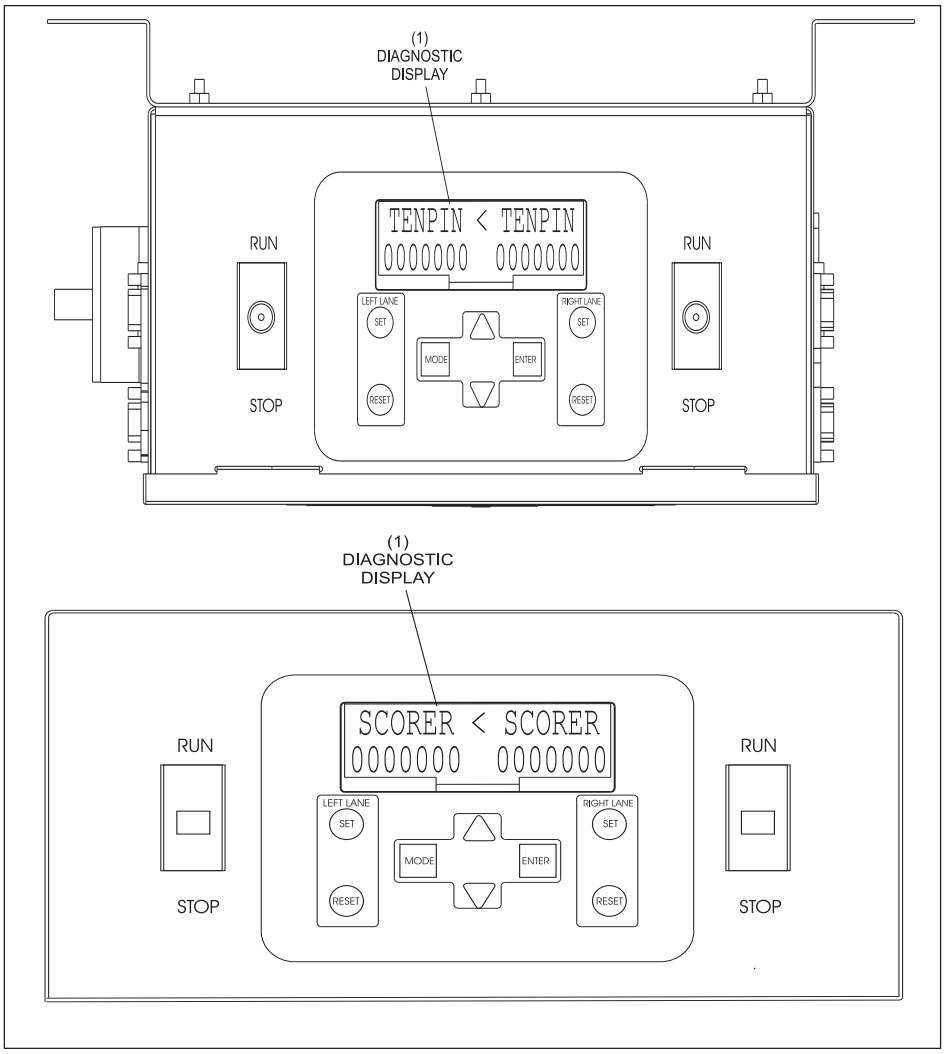


Figure 6-1. Top of Nexgen Controller / Mechanic's Remote Display.

Table 6-1 lists the error codes that may be displayed when the Pinsetter CPU has detected a problem with the pinsetter.

The Error Display symbol indicates which switch failed to act normally. A description and possible cause of failing are contained in this section of the manual.

Table 6-2 lists invalid machine states and switch positions.

Std. Code	Extended Code	
P0	Pin OOR	Out-of-Range
01	Pin1 Ld	Pin Loading Time Out Pin 1
02	Pin2 Ld	Pin Loading Time Out Pin 2
03	Pin3 Ld	Pin Loading Time Out Pin 3
04	Pin4 Ld	Pin Loading Time Out Pin 4
05	Pin5 Ld	Pin Loading Time Out Pin 5
06	Pin6 Ld	Pin Loading Time Out Pin 6
07	Pin7 Ld	Pin Loading Time Out Pin 7
08	Pin8 Ld	Pin Loading Time Out Pin 8
09	Pin9 Ld	Pin Loading Time Out Pin 9
10	Pin10 Ld	Pin Loading Time Out Pin 10
50	Detect10	#10 Pin Not Detected in Diagnostics
51	Detect1	#1 Pin Not Detected in Diagnostics
52	Detect2	#2 Pin Not Detected in Diagnostics
53	Detect3	#3 Pin Not Detected in Diagnostics
54	Detect4	#4 Pin Not Detected in Diagnostics
55	Detect5	#5 Pin Not Detected in Diagnostics
56	Detect6	#6 Pin Not Detected In Diagnostics
57	Detect7	#7 Pin Not Detected in Diagnostics
58	Detect8	#8 Pin Not Detected in Diagnostics
59	Detect9	#9 Pin Not Detected in Diagnostics
60	A Found	Switch A is Not Expected But Found
61	B Found	Switch B is Not Expected But Found
62	C Found	Switch C is Not Expected But Found
63	D Found	Switch D is Not Expected But Found
64	SMFound	Switch SM is Not Expected But Found
65	G Found	Switch G is Not Expected But Found
66	STFound	Switch ST Is Not Expected But Found
67	OORFound	SW. OOR is Not Expected But Found
70	A Ntfnd	Switch A Expected But Not Found
71	B Ntfnd	Switch B Expected But Not Found
72	C Ntfnd	Switch C Expected But Not Found
73	D Ntfnd	Switch D Expected But Not Found
74	SM Ntfnd	Switch SM Expected But Not Found
75	G Ntfnd	Switch G Expected But Not Found
76	STNtfnd	Switch ST Expected But Not Found
90	Invld 0	Invalid Machine State 0
91	Invld 1	Invalid Machine State 1
92	Invld 2	Invalid Machine State 2
93	Invld 3	Invalid Machine State 3
94	Invld 4	Invalid Machine State 4
95	Invld 5	Invalid Machine State 5
EJ	ElevJam	Elevator Jam
EL	Pin Cnt	Pin Count Switch Shorted for 5 Seconds
J1	TS1 Jam	Jam Switch TS1
J2	TS2 Jam	Jam Switch TS2 (Tower)
	BA	Accelerator Motor (overload)
	IL	Interlock Switch Open
	PF	Power Failure Has Ocurred

Table 6-1. Error Display

Error Code	Switch Status				Problem
	Table	Sweep		Spotting Tongs	
	"A"	"G"	"SM"	"ST"	
90 (Invld 0)	Actuated	Un-Actuated	Un-Actuated	Actuated	Sweep is up but it is not forward.
91 (Invld 1)	Un-Actuated	Un-Actuated	Un-Actuated	Actuated	Sweep is up but it is not forward and the Table is not at home position.
92 (Invld 2)	Un-Actuated	Actuated	Un-Actuated	Actuated	Sweep not forward, Table is not at home position
93 (Invld 3)	Actuated	Un-Actuated	Un-Actuated	Un-Actuated	Sweep is up but it is not forward and the Spotting Tongs are closed.
94 (Invld 4)	Un-Actuated	Un-Actuated	Un-Actuated	Un-Actuated	Sweep is up but it is not forward, the Table is not at home position and the Spotting Tongs are closed.
95 (Invld 5)	Un-Actuated	Actuated	Un-Actuated	Un-Actuated	Sweep is not forward, the Table is not at home position, and the Spotting Tongs are closed.

Table 6-2. Invalid Machine States.

NOTE: *Some errors or problems with the pinsetter may not be detected by the Pinsetter CPU. Examples are ball accelerator problems or scoring errors.*

4. Clear the jam, repair or replace the failed part, or make the adjustment.

5. Turn the STOP/RUN switch to the run position.

NOTE: *When working on a pinsetter always observe proper safety procedures. Refer to the* "Safety Guidelines" *outlined at the beginning of this manual.*

6. If the machine will not restart, recheck the error code diagnostic display. If an invalid state is displayed, you must return the table (up) or sweep (forward) to its home position.

Cable Repair

1. When a cable is “inoperative” on a pinsetter, swap the cable with a spare cable, or with one from another pinsetter to see if the one in question is good or bad.

    a. To repair a cable, carefully inspect connections on each end of the cable for damage, such as bent or broken pins or loose, crimped connections and hold down springs. Ribbon cables generally cannot be repaired and must be replaced.

    b. Use an ohm meter or the “SW DIAG” mode of the Nexgen box for checking continuity through pins and wires. Refer to *“Nexgen”* Section for cable drawings. On long cables, jumper two pins and check the other ends with meter for continuity.

Error Code Description and Causes

STD. CODE	EXTENDED CODE *	FAILURE DESCRIPTION	POSSIBLE CAUSES
PO	Pin OOR	TABLE CAN'T PICK UP PINS, OUT-OF-RANGE - The Table was unable to lower to it's normal detecting height.	1. A bowling pin has been moved off its normal spot when the bowler rolled the ball. The table came down and it was resting on top of the pin. Turn off the power, clear any fallen pins still on the playing surface of the lane, and turn power back on. 2. The OOR switch mounted on the tower is not being actuated. Check the switch and actuating cam for proper adjustment. Check the wiring and connections between the switch and P-1/P-23 on the Nexgen Controller. 3. Switch cluster timing cam out of adjustment. 4. Table is not lowering properly. Check for binds in the table racks or the chain lowering mechanism.
01 02 03 04 05 06 07 08 09 10	Pin1 Ld Pin2 Ld Pin3 Ld Pin4 Ld Pin5 Ld Pin6 Ld Pin7 Ld Pin8 Ld Pin9 Ld Pin10 Ld	PIN LOADING TIME OUT A pin was not loaded into the pinholder within 90 seconds.	1. Pins jammed in one of the distributor lanes preventing the pin station form receiving a pin. 2. Pin holder switch not working properly. Check for broken switch or wiring. 3. Pin Holder solenoid not energizing. Check the solenoid, the wiring and the Nexgen Controller. 4. Table height too high, preventing the pin from dropping properly into the pin holder to make the switch. 5. Table height too low preventing the pin holder's open gripper from pushing up on the pin release lever to drop the pin. Also check individual pin release lever for proper positioning. 6. Pin count switch not functioning properly. 7. For Nexgen Electronics, swap the CPU PCB. Also, swap the interconnecting cables to help isolate the problem.

CODE	EXTENDED CODE*	FAILURE DESCRIPTION	POSSIBLE CAUSES
50 51 52 53 54 55 56 57 58 59	Detect10 Detect1 Detect2 Detect3 Detect4 Detect5 Detect6 Detect7 Detect8 Detect9	PIN NOT DETECTED IN DIAGNOSTICS - These ten codes are used during Machine Cycling diagnostics only. If a standing pin is not detected when the pinsetter is operating in this mode, the pinsetter will stop and display the code for the pin not detected. To activate this option set the Enable 50 Err setup option to "Y"	1. Check the pin detector plate for proper positioning. Is it level from left to right. 2. Check the Stroke Limiter height adjustment. 3. Check the setting table levelness. 4. Check the angle "1" and "2" adjustment.(Pinsetter Timing) 5. Check stroke limiter shock.
60	A Found	SWITCH A NOT EXPECTED BUT FOUND - Pinsetter CPU has requested that the table be lowered but the "A" switch is still being held closed.	1. Table Motor or brake defective preventing table from being lowered. 2. The wiring between the switch and P-1/P-23 on the Nexgen Controller is defective. 3. Bad Connection on the H.V. PCB or Bad H.V. PCB (Nexgen) 4. Faulty A-Switch
61	B Found	SWITCH B NOT EXPECTED BUT FOUND - This switch was actuated at the wrong time or continuously.	1. Switch "B" on the switch cluster is shorted. Check the wiring and the switch. 2. Table motor or brake defective
62	C Found	SWITCH C NOT EXPECTED BUT FOUND - This switch was actuated at the wrong time or continuously.	1. Switch "C" on the switch cluster is shorted. Check the wiring and the switch. Nexgen CPU defective. Check the wiring and swap the PCBs with a working lane pair. 2. Table motor or brake defective.
63	D Found	SWITCH D NOT EXPECTED BUT FOUND - This switch was actuated at the wrong time or continuously.	1. Switch "D" on the switch cluster is shorted. Check the wiring and the switch. 2. Table motor or brake defective 3. Nexgen CPU defective. Check the wiring and swap the PCBs with a working lane pair.
64	SMFound	SWITCH SM NOT EXPECTED BUT FOUND - This sweep motor switch is actuated when it should not have been.	1. Sweep motor defective. 2. Sweep motor brake defective or stuck on the motor shaft. 3. No power to the sweep motor and/or brake. Check wiring for damage and proper hookup. 4. "SM" switch shorted. Wiring between the Nexgen Controller and the switch is shorted. 5. Sweep wagon or sweep arms binding or roller out of adjustment.

CODE	EXTENDED CODE *	FAILURE DESCRIPTION	POSSIBLE CAUSES
65	G Found	SWITCH G NOT EXPECTED BUT WAS FOUND - This error is detected when the sweep is down when it should be up in the raised "waiting for a ball" position.	1. Replacement table motor is wired so so the table is running backwards. 2. Sweep release assembly defective. Check for broken parts, missing spring or a sticky solenoid plunger. 3. Sweep release assembly out of alignment causing it to miss the sweep during the clockwise rotation of the table shaft. 4. Sweep wagon's forward position out of adjustment. Check both sweep arms and make sure both sweep craNK links on the sweep shaft are tight. "G" Switch shorted. Wiring between the Nexgen Controller and the switch is shorted.
66	STFound	SWITCH ST NOT EXPECTED BUT WAS FOUND - Spotting tong switch is actuated when it should not have been. This means that the tongs are in thier open position when they should have closed.	1. Spotting tong solenoid not energizing. Check fuses on Nexgen CPU PCB. 2. Spotting tong clutch slipping. Clean, reset tension and readjust. 3. One or more set of spotting tongs damaged or binding. 4. Drive gears on the square shaft or out of adjustment. 5. "ST" shorted or wiring on the table damaged.
67	OORFound	SWITCH OOR NOT EXPECTED BUT FOUND - The Out-of-Range switch, located on the tower, is actuated when it should not have been.	1. The "OOR" switch is shorted or damaged. 2. The wiring from the switch to the Nexgen Controller is faulty. 3. The Nexgen Controller CPU may be defective.
70	A Ntfnd	SWITCH A EXPECTED BUT NOT FOUND - Table is not at the fully raised to "home" position.	1. "A" switch is defective or out of adjustment. 2. Table motor or brake defective. 3. Check wiring connections and motor and brake connections. 4. Reversing fuses on Nexgen High Voltage PCB that are blown.
71	BNtfnd	SWITCH B EXPECTED BUT NOT FOUND - "B" switch was not made when table lowered to detect or set pins.	1. Switch "B" defective or out of adjustment. 2. The wiring from the switch to the Nexgen Controller is faulty 3. The Nexgen Controller CPU PCB may be defective. 4. Reversing fuses on Nexgen High Voltage PCB that are blown 5. Table motor or brake is defective

CODE	EXTENDED CODE *	FAILURE DESCRIPTION	POSSIBLE CAUSES
72	C Ntfnd	SWITCH C EXPECTED BUT NOT FOUND - Switch "C" is not actuated as expected during a pinsetter cycle.	1. Table motor or brake defective. 2. Check wiring from Nexgen Controller H.V. PCB to table motor and brake. 3. Table motor wired to run backward. Reverse any two of the "hot" leads coming into the motor terminal block. 4. Switch "C" defective or adjusted too far away from the magnetic switch activator. 5. The Nexgen Controller CPU PCB may be defective. 6. Reversing fuses on Nexgen High Voltage PCB that are blow.n 7. Table motor or brake is defective.
73	D Ntfnd	SWITCH D EXPECTED BUT NOT FOUND - "D" switch was not made when table lowered to detect or set pins.	1. Switch "D" defective or out of adjustment. 2. The wiring from the switch to the Nexgen box is shorted. The Nexgen Controller 3. CPU PCB may be defective. 4. Reversing fuses on Nexgen High Voltage PCB that are blown 5. Table motor or brake is defective
74	SM Ntfnd	SWITCH SM EXPECTED BUT NOT FOUND - This error indicates that the sweep is not forward or is unable to stop at the forward position.	1. Sweep motor brake not preventing the motor from coasting. 2. "SM" switch not being actutated. 3. The Nexgen Controller CPU PCB may be defective. 4. Defective Nexgen High Voltage PCB.
75	G Ntfnd	SWITCH G EXPECTED BUT NOT FOUND - Indicates that the sweep did not lower all the way down to the guarding "ready to sweep" position.	1. Sweep down on top of a pin or ball. 2. Sweep release solenoid defective. 3. Sweep release mechanism damaged or defective. 4. Switch "G" out of adjustment. 5. The wiring between the Nexgen Controller and the sweep release solenoid or "G" switch is defective. 6. The Nexgen Controller CPU PCB may be defective.
76	STNfnd	SWITCH ST EXPECTED BUT NOT FOUND - Indicates that the spotting tongs are not all the way open.	1. Spotting tong clutch - clean and adjust. 2. Spotting tong switch damaged or out of adjustment. 3. Spotting tong solenoid not working properly. 4. The wiring between the Nexgen Controller and the switch is loose or damaged. 5. Spotting tongs not working properly - damaged or binding. A replacement set of tongs could have been installed out of time with the other tongs.

CODE	EXTENDED CODE *	FAILURE DESCRIPTION	POSSIBLE CAUSES
90 91 92 93 94 95	Invld 0 Invld 1 Invld 2 Invld 3 Invld 4 Invld 5	INVALID MACHINE STATES 0-5 These states are situations which the Pinsetter CPU is not able to determine where the table, sweep and spotting tongs are. Most times this is caused by an incomplete clearing of a table or sweep jam by the mechanic.	1. Check the position of the table, sweep and spotting tongs. Moving the sweep to the fully forward position will normally allow the pinsetter to restart itself. 2. The sweep is not making the "SM" switch in order for the table motor to run. 3. The table is not "up" making the "A" switch in order for the sweep motor to run. 4. Check the "SM" switch with the sweep forward. 5. Check the "G" switch the sweep up. 6. Check the "A" switch with the table up. 7. Check the "ST" switch with the tongs fully open. 8. Check the Nexgen Controller CPU PCB cables for proper connections, both internally and externally.
EL	Pin Cnt	Pin count switch closed continuously.	1. Pin jam at the Shark assembly pin guides. 2. Switch is stuck in the closed position. 3. The wiring between the Nexgen Controller and the switch is shorted. 4. The Nexgen Controller CPU PCB is defective.
EJ	Elev Jam	ELEVATOR JAM - Elevator shovels not rotating properly. "EC" switch on elevator not being pulsed by a pin shovel at least once every 6 seconds.	1. Elevator pin shovel flipped and wedged in the elevator. 2. Pin caught in the elevator preventing rotation of the shovels. 3. Transport drive has a bind which prevents the rear distributor shaft from rotating elevator fast enough to keep pulsing "EC" switch. 4. Distributor motor defective. 5. Belt drive from the motor to the distributor shafts is too loose.
J1	TS1 Jam	JAM SWITCH TS1 - The switch is made when the rear pin holder swing shaft is unable to return to the horizontal position after setting pins.	1. A pin, broken part or tool is stuck in the table preventing rotation of the swing shafts. 2. The TS1 jam mechanism is out of adjustment and allows the switch to be made during proper rotation of the swing shafts. 3. The TS1 switch or its wiring to the Nexgen Controller is shorted.
J2	TS2 Jam	JAM SWITCH TS2 (TOWER) - This switch is made when the table is prevented from raising to its home position.	1. A pin, broken part or tool is wedged between the table and distributor. 2. The table height adjustment is wrong allowing the table to be pulled up against the distributor. Check the Angle "1" & "2" adjustment of the table and the table height in the raised position adjustments. 3. Check the TS2 adjustment to make sure the spring tension is adjusted properly. 4. The wiring to the Nexgen Controller is possibly shorted.
*	BA	BALL ACCELERATOR- Thermal protection activated or accelerator cable not connected.	1. Ball or pin stuck in accelerator clear obstruction. 2. Accelerator(AS) cable broken or disconnected. Check accelerator cable.

NOTE: *Nexgen Electronics displays either Standard Code or Extended Code*

**= Nexgen Electronics only*

Problem/Cause/Corrective Action

PROBLEM	CAUSE	CORRECTIVE ACTION
1. Ball does not return.	1. Pins in accelerator. 2. Adjoining machine transport band binding ball door. 3. Ball doors do not move freely. 4. Pin stuck between transport band and ball cushion board. 5. Transport band drive belt broken, or slipping. 6. Broken transport band. 7. Faulty ball door solenoid. 8. Accelerator flat belt. 9. Ball fell off transition track.	1. Remove pins. 2. Adjust transport band. 3. Adjust or lubricate ball door. 4. Adjust ball cushion. 5. Replace or weld belt. See Servicing section. 6. Replace transport band. 7. Replace or adjust solenoid. 8. Tighten or replace belt as required. 9. Remove capping, retrieve ball and clear any obstruction on or near the track.
2. Ball door blocked by pins.	1. Ball cushion not adjusted properly. 2. Loose transport band. 3. Loose transport band drive belt. 4. Worn transport band. 5. Ball door not adjusted properly.	1. Adjust ball cushion. 2. Tighten transport band. 3. Cut off a piece and weld back together. 4. Replace transport band. 5. Adjust ball door.

PROBLEM	CAUSE	CORRECTIVE ACTION
3. Pinsetter does not turn on properly.	1. TS1 or TS2 safety switch actuated. 2. Photocell not adjusted properly. 3. Faulty switch "A" or "SM". 4. Nexgen Controller main switch is off. The main power cable is unplugged, the mechanic's rear stop switch is not on. 5. Main house breaker box (if two pinsetters are down.) 6. Incorrect line voltage. 7. Pinsetter set to wrong mode.	1. Determine cause of trouble, repair, and restart machine. 2. Adjust ball detector. 3. Replace or adjust switch. 4. Turn on all switches. Check plugs and connectors. 5. Reset breakers. 6. Have line voltage corrected. 7. Set machine to proper mode
4. Pinsetter cycles independently. (One cycle only.) CAUTION: Camera flash may cause pinsetter to cycle independantly.	1. Photocell not adjusted properly. 2. Loose reflector mounting. 3. Faulty power supply connections. 4. Nexgen mode setting is wrong. 5. Incoming 3 phase power surge, or is out of balance	1. Check for proper hardware and adjust. 2. Remount with proper hardware and adjust. 3. Tighten connections. 4. Place pinsetter mode in 10-pin mode (stand alone pinsetters) or in (Frmwrx) mode if attached to the Frameworx scorer. 5. As a last resort, consult a qualified electrician to help identify the surge and correct the problem.

PROBLEM	CAUSE	CORRECTIVE ACTION
5. Pinsetter cycles continuously.	1. "SET" switch on mechanic's rear control box stuck or faulty. 2. Bowler's reset button stuck or cable is shorted.	1. Replace or repair as needed. 2. Check reset button, check cable, repair or replace.
6a. No pinsetter motor will operate.	1. Safety switches TS1 or TS2 actuated. 2. Manager's remote control unit not turned on. (Stand Alone pinsetters only) 3. Faulty Nexgen H.V. PCB	1. Determine cause of trouble, repair, and restart machine. 2. Turn on switch. 3. Relplace Nexgen H.V. PCB.
6b. Individual motor does not operate.	1. Main house breaker box or faulty power supply connections. 2. Faulty cables. 3. Damaged motor. 4. All above checked faulty Nexgen CPU or H.V. PCB.	1. Check breaker box and tighten power connections. 2. Check for shorted or loose pins, continuity, faulty connectors. Repair or replace. 3. Replace motor. 4. Power down and exchange faulty box.
7. Pinsetter fails to sweep.	1. Pin under or on top of sweep. 2. Faulty switch G, OOR or SM. 3. Sweep wagon guide rollers not adjusted properly. 4. Broken or worn sweep drive belt.	1. Remove pin. 2. Adjust or replace switch. 3. Adjust guide rollers. 4. Replace belt.

PROBLEM	CAUSE	CORRECTIVE ACTION
8. Sweep motor runs continuously.	1. Sweep motor brake defective. 2. Faulty switch SM. 3. All above checked. Faulty electronic assemblies or Nexgen CPU or H.V. PCB.	1. Adjust motor. 2. Adjust or replace switch. 3. Power down and exchange faulty box. or PCBs.
9. Pins jammed in distributor.	1. Oil/grease on pins or belts. 2. Belts not tensioned properly, dragging in rails. 3. Distributor belts off or broken. 4. Broken pin slider in pin station. 5. Front distributor and idler gears do not have proper tooth gap or belts are not tensioned properly. 6. Belts not level on distributor or riding in top of belt rail.	1. Clean with all-purpose cleaner. 2. Remove section of belt and weld back together, lubricate belt 3. Replace or weld belt. 4. Replace as required. 5. Adjust for proper tooth gap. Replace or weld belt for proper tension. 6. Adjust pulleys so the belts ride properly in rail
10. Shark switch not flipping to load pins on the right pin side.	1. Shark solenoid. 2. Pin count switch not closing.	1. Change solenoid or make sure solenoid is plugged in. 2. Check wiring to Nexgen Controller. Adjust switch, replace or repair switch or wirining.
11. Incorrect score.	1. Pin detect switch. 2. Pin detection height is not correct. 3. Angle "1" or "2" not adjusted 4. Broken pin detector plate.	1. Switch actuator or switch is sticking. 2. Adjust stroke limiter. 3. Adjust angle "1" or "2". 4. Replace pin detector plate.

PROBLEM	CAUSE	CORRECTIVE ACTION
12. Pins jammed in overflow chute.	1 Dirty pins and/or dirt built up in pin overflow chute.	1. Clean pins with pin cleaner and/or clean chute with all purpose cleaner.
13. Pin elevator turns continuously.	1. Faulty Nexgen CPU or H.V. PCB .	1. Replace Nexgen CPU or H.V. PCB.
14. Pinsetter runs for six seconds then turns off.	1. Elevator switch defective. 2. Pin jam in elevator. 3. Faulty Nexgen CPU PCB .	1. Replace or adjust switch. 2. Remove pins. 3. Replace faulty electronic assembly.
15. Table motor runs continuously.	1. Faulty switch A, or cam misadjusted. 2. Missing screw on switch actuator. 3. Faulty Nexgen CPU or H.V. PCB .	1. Adjust or replace actuator. 2. Replace screw or switch actuator. cam as required. 3. Replace faulty electronic assembly.
16. Table sets pins but sweep stays down.	1. Sweep not fully forward. 2. Sweep attenuator stop screw not adjusted properly. 3. Sweep pick up chain not adjusted to proper length. 4. Sweep contacting gutter adapter blocks. 5. Sweep release assembly bound. 6. Table motor running backwards. 7. Nexgen controller set table delay set to "N"	1. Move sweep manually by turning middle pulley. 2. Adjust stop screw. 3. Adjust to proper length using screw on end of chain. 4. Adjust sweep board. 5. Free bind in sweep release assembly. 6. Re-wire motor for correct rotaion. 7. Set table delay to "Y".

PROBLEM	CAUSE	CORRECTIVE ACTION
17. Full table lowers but does not release all pins.	1. Setting table not adjusted for proper height. 2. Faulty pin holder solenoids or pin holder microswitches. 3. Faulty electrical connections.	1. Adjust setting table. 2. Repair or replace faulty solenoid or microswitch. 3. Repair connections.
18. Table does not set full rack of pins.	1. Faulty pin holder switches or switch finger. 2. Pin detectors not allowed free movement. 3. Faulty pin holder solenoid(s), or cable harness's. 4. Faulty stroke limiter solenoid.	1. Replace switch or switch finger. 2. Determine cause and adjust as required. 3. Replace solenoid(s). Check harness cable and connectors. 4. Check stroke limiter solenoid and wiring.
19. Table makes long stroke only.	1. Stroke limiter not adjusted properly. 2. Faulty solenoid. 3. Faulty cable.	1. Adjust stroke limiter. 2. Replace or adjust solenoid as required. 3. Repair or replace cable.
20. Table makes short stroke only.	1. Faulty pin holder switch. 2. Faulty stroke limiter solenoid. 3. Pin holder shaft latch not adjusted properly. 4. Faulty cable.	1. Replace switch or adjust . 2. Replace solenoid as required. 3. Adjust pin holder shaft latch. 4. Repair or replace cable.

PROBLEM	CAUSE	CORRECTIVE ACTION
21. Table does not set pins after second ball or table is not full.	1. Pin jam in distributor. 2. Bent pin distributor guide tabs. 3. Faulty pin holder solenoid. 4. Table not adjusted to proper height. 5. Broken pin station on distributor. 6. Not enough pins in machine. 7. Broken pin holder electrical connections. 8. Faulty electronics. 9. Faulty pin holder switch or switch actuator.	1. Remove jam. 2. Adjust as required. 3. Replace solenoid as required. 4. Adjust table. 5. Replace as required. 6. Be certain 22 pins are in machine. 7. Repair connections. 8. Change the Nexgen CPU PCB. 9. Repair pin holder switch or switch actuator.
22. Table is full but does not lower.	1. Faulty pinholder microswitches. 2. CPU fuse Is blown (Nexgen). 3. Faulty Nexgen CPU or H.V. PCB . 4. Pin holder switch actuator sticking. 5. Pin detector plate stuck up. 6. Pin holder out of postion detector plate hangs up.	1. Adjust or replace microswitches. 2. Replace fuse 3. Replace faulty box or PCB. 4. Repair 5. Check clearance between plate and pin holders. 6. Adjust pin holder assembly.
23. Pins wobble or fall over while being set.	1. Pin holders not plumb. 2. Table not adjusted for proper height. 3. Table is not completely level. 4. Faulty table spring. 5. Pin bottoms are worn.	1. Make sure pin holders are vertical. 2. Adjust table height. 3. Level table. 4. Replace spring. 5. Scrap or repair worn pins.

PROBLEM	CAUSE	CORRECTIVE ACTION
24. Pin holder double loads.	1. Pin holder switch sticks. 2. Switch actuator sticks. 3. Pin detector plate stuck up. 4. Pin not seated in pin holder. 5. Pin holder switch finger cracked. 6. Broken wires or loose pin holder switch connectors. 7. Bad Nexgen PCB or loose connection	1. Replace Switch 2. Lube, check switch actuator. 3. Check detector plate pins, pin holder location in relation to other pin holders. 4. Check pin holder position and table height. 5. Replace switch finger. 6. Check table harness and switch wires. 7. Check connections and replace Nexgen PCB as needed.
25. Spotting tongs do not close - table does not pick up standing pins.	1. Tong drive clutch dirty or lubricated. 2. Tong drive shaft clutch not adjusted to proper tension. 3. Faulty spotting tong solenoid. 4. Faulty spotting tong switch or out-of-range switch. 5. Spotting tongs are obstructed. 6. Faulty Nexgen CPU. 7. Stroke limiter Assembly set too high (score strike)	1. Remove all lubricants and dirt from clutch face. 2. Adjust tension. 3. Change solenoid, check cable. 4. Adjust or replace switches as required. 5. Clear obstruction. 6. Change the Nexgen CPU PCB. 7. Adjust stroke limiter.
26. Pins drop from tongs.	1. Missing or worn tong insert. 2. Broken tong. 3. Tong out of time with other tongs 4. Spotting tong drive shaft clutch not adjusted to proper tension. 5. Table gears obstructed. 6. Faulty cables. 7. Switches B or D are faulty or not adjusted properly.	1. Replace tong insert. 2. Replace broken tong. 3. Check for proper movement of tongs. Realign tong an drive gear. 4. Adjust for proper tension. 5. Clear obstruction. 6. Repair or replace cables. 7. Adjust switch for gap. Replace if switch is faulty.
27. Ball accelerator belt not centering.	1. Front pulley not bolted correctly or front yoke is loose (parts incorrectly installed.)	1. Loosen bolts on yoke and operate accelerator. Align both yoke halves until the belt runs true. Tighten bolts.

PROBLEM	CAUSE	CORRECTIVE ACTION
28. Pinsetter operates erratically.	1. Faulty switch A. 2. Loose or faulty cables and connections. 3. Switches B, C, or D, (on switch cluster) or switch OOR (on setting table guide tower) not adjusted properly. 4. Setting table height not adjusted properly. 5. Belts not tensioned properly. 6. Damaged pinsetter parts. 7. Pin holder latch not adjusted properly. 8. Release levers damaged or not adjusted properly. 9. Switch adjustment faulty or faulty assembly. 10. Photocell adjustment not correct. 11. Faulty motor rotation. 12. Main power supply on too low a voltage. 13. Faulty switch cluster cable, trouble light, and ball door cable. 14. Faulty, ball lift cable, foul & optical trigger cable. 15. After above checked, electronics.	1. Replace switch. 2. Use solenoid and cable checker. 3. Adjust switches or cam for B, C, or D and OOR. 4. Adjust table height. 5. Check all belts for proper tension. Replace or weld belts as required. 6. Repair or replace parts. 7. Adjust latch. 8. Replace levers or adjust as required. 9. Check switch mountings. Check adjustments. 10. Adjust ball detect. 11. Determine proper rotation and adjust to proper phase status. 12. Use proper line voltage. 13. Substitute spare cable (to check). 14. Check cables and repair or exchange. 15. Change the Nexgen CPU or H.V. PCB

Contents

General Information 7-3

1. Inspection (and correcting any problem found) 7-3

2. Cleaning 7-4

3. Lubricating 7-4

Oiling 7-4

Greasing 7-4

Proper Lubricants 7-4

Materials Required for Preventive Maintenance 7-5

Sub-Assembly Preventive Maintenance Inspection 7-6

Elevator Assembly 7-6

Transport Band Assembly 7-6

Ball Cushion and Pit Curtain 7-7

Ball Accelerator Assembly 7-7

Sweep Wagon Assembly 7-7

Setting Table Assembly 7-8

Drive Frame Assembly 7-9

Electrical 7-10

Power Ball Lift 7-10

Administration and Organization 7-10

Main Frame Assembly 7-11

Distributor Assembly 7-11

Detailed Maintenance Schedule 7-14

Variable Schedule Items 7-14

Fixed Schedule Items 7-14

Daily Maintenance 7-14

Weekly Maintenance 7-14

Monthly Maintenance 7-15

Quarterly Maintenance 7-15

Semi-Annual Maintenance 7-16

Annual Maintenance 7-17

Lubrication 7-18
Monthly 7-18
Quarterly 7-21
Semi-Annual 7-30
Annual 7-33
Maintenance Forms 7-34

Section 7: Preventive Maintenance

General Information

Preventive maintenance is the most important responsibility of the pinsetter mechanic. Properly performed preventive maintenance will increase reliability, prevent major breakdowns and lengthen the life of the pinsetter.

Preventative maintenance should begin when the pinsetters are installed. Waiting until the pinsetters are dirty and operating poorly will create a situation that can quickly become unmanageable.

Finally, it is a very poor practice to rely on memory in servicing any machinery.

An example of a typical work schedule is included that will allow you to track the maintenance as it is being done. The following pages of this section list step by step guidelines on what should be done and how often. Careful study of the contents of this section and proper use of the work schedule will result in clean, well operating machines and will greatly lengthen the useful life of your pinsetters.

Tip: Combining the following activities during preventative maintenance can save time and effort.

In general preventative maintenance requires the following:

1. Inspection (and correcting any problem found)

The pinsetter should be inspected periodically for the following condition:

- Loose hardware
- Damaged or worn parts
- Cracked/fatigued metal or welds
- Proper adjustments

For optimum machine operation, a mechanic should correct any pinsetter problems such as loose hardware or adjustments immediately. If corrective action cannot be done immediately it should be logged on the “pending work item “ form for the machine.

In addition all pinsetter malfunctions should be recorded on the pinsetter “Stop Sheet” that should be attached to the elevator of every machine. This form is invaluable in determining the reliability and performance of your pinsetters as well as the impact of the maintenance.

Finally, if a problem is observed on a pinsetter, check the other pinsetters for the same problem.

2. Cleaning

The frequency for cleaning the pinsetter depends on the type and quantity of lane conditioner (oil) used, the environment that the pinsetter in operating, and the amount of bowling activity for the pinsetter.

In general the pinsetter should be kept as clean as possible using a vacuum, general purpose cleaner, warm water (with detergent as needed), and Invincible cleaner.

3. Lubricating

Proper application of lubricants is essential for the operation and long life of the pinsetter.

Oiling

Always use a oil can or applicator that proviced sufficient control of the quantity of oil being applied. This will prevent over oiling where extra oil will drip off into the wrong area and cause problems, part failures or interfere with bowling activity.

Greasing

It is always a good practice to wipe off the old grease and dirt it has collected with it BEFORE applying a new coat of grease. Do not over grease the part as the grease can get into areas that can cause problems or interfere with the machine operation.

Proper Lubricants

Always use the proper lubricants such as those specified in the this manual. Penetrating oils do not last long and leave parts exposed to premature failure. Some lithium greases have a tendency to dry and harden quickly. This can lead to sticky parts or premature failure. Other lubricants may be detrimental to plastic parts. It is suggested to use non-lithium or equivalent grease on the pinsetter.

Materials Required for Preventive Maintenance

- Metric tool set

- Vacuum cleaner - tank style

- Small paint brush for applying grease

- Cleaning cloths

- Bucket and scrubbing brush (and/or a scrubbing mop)

- Oil can with long rigid or flexible spout

- Lubricating oil (30 weight non-detergent)

- Lubricating grease - medium duty non-lithium - such as:
  Brunswick Part No. 11-676361-000

- General purpose cleaner - a non-residue detergent type such as:
  Brunswick GPC Part No. 62-860085-005 (5 gallon container)

- Brunswick Pinsetter Cleaner - Part No. 62-860083-005 (5 gallon container)

- Chain Lubricant

Sub-Assembly Preventive Maintenance Inspection

Elevator Assembly

1. Inspect condition of the frame and frame welds. Check for loose or missing hardware.

2. Inspect all shafts, bearings, sprockets, chains and pulleys for condition and adjustment. Check all pin shovels and shovel hardware. Inspect all shovel pivot levers.

3. Inspect condition and mounting of guards and verify guard identification labels are in place.

4. Inspect the mounting and adjustment of the elevator control, (EC) switch, as well as the mounting and function of Mechanic's rear control box or remote display, and trouble light. Verify that all elevator cables are intact and routed correctly.

5. Inspect the mounting hardware, condition and adjustment of the shark assembly and pin guide wedges. Check the shovel cam for adjustment and condition. Check the alignment and mesh of the drive gears. Inspect the condition and operation of the shark fin. Inspect the tensioning and condition of the transfer belts. Inspect the mounting hardware and condition of the deflector shoe.

6. Inspect the condition, alignment, adjustment and operation of the pin count switch.

7. Check the smart shark solenoid and solenoid linkage. Check for proper operation of the smart shark. Check all mounting hardware and fasteners.

Transport Band Assembly

1. Inspect the condition of the welds and mounting hardware on the pit side frames.

2. Inspect the mounting hardware and condition of the transport band boards. Check the condition and tracking of the transport band carpet. Inspect the front and rear rollers for bearing and shaft condition, correct tensioning and alignment in mounting slots. Inspect the condition and operation of the centering guide rollers.

3. Inspect the condition and tensioning of the transport band drive belts. Inspect the mounting hardware on the idler and tensioner assemblies. Check the condition of the idler pulleys.

4. Inspect the condition and mounting hardware on the pin feed deflectors and mounting brackets. Check the adjustment on the pin feed deflectors.

Ball Cushion and Pit Curtain

1. Inspect the condition and mounting hardware on the ball cushion board and the impact strips. Check the attachment of the rubber cushion to the board and the facing to the rubber cushion. Inspect the cushion frame welds, and check the mounting hardware. Inspect the nylon cushion bearings for wear and check the location and hardware on the stop collars. Inspect the cushion assembly for proper adjustment.

2. Inspect the mounting, and adjustment of ball cushion shock absorber. Inspect the mounting and location of the shock absorber adjustment plate.

3. Inspect the condition and mounting of the overflow chutes. Inspect the condition and adjustment of the overflow socks.

4. Inspect the condition of the pit curtain and check the mounting hardware.

5. Verify that the grounding strap is properly connected between the ball cushion frame and the ball accelerator box.

Ball Accelerator Assembly

1. Inspect the condition of the frame welds. Check that foot guards are in place. Inspect the condition and location of the ladder.

2. Inspect the condition and mounting hardware on the ball door protector plate.

3. Inspect the accelerator motor. Check for excessive vibration or noise.

4. Inspect the condition of the flat belt.

5. Inspect the ball door and ball door locking mechanism for proper adjustment. Check the condition of the ball door, ball door button and door locking bolt. Inspect the ball door solenoid for correct operation. Check the routing of the solenoid cable. Verify that ball door open and closes freely.

Sweep Wagon Assembly

1. Inspect the condition of the sweep wagon frame and frame welds. Check the roller mounting and adjustment. Check the conditions of the pusher rods and pusher rod bushings. Inspect the conditions of the protector blocks and block mounting hardware. Check all sweep wagon hardware.

2. Inspect the condition of the sweep board and adapters. Check the adjustment of the sweep board and adapters.

3. Inspect the condition of all sweep release mechanism components. Check all sweep release mounting hardware. Inspect for missing springs or worn linkage and pivot bushings. Check the condition of the chain and pivot bearing. Check the operation of the solenoid. Inspect the solenoid cable routing.

4. Inspect the sweep attenuator and sweep shock absorber for loose or missing hardware. Check the attentuator and "G" switch for proper adjustment. Inspect all pivot points for wear. Inspect the "G" switch cable routing.

Setting Table Assembly

1. Inspect the setting table frame for wear or broken welds. Check for loose or missing hardware. Check the vertical swing shaft stop bolt for proper adjustment. Inspect the condition of the vertical helper springs.

2. Check for loose or missing spotting tong and geared rack hardware. Inspect the "ST" switch mounting and check the adjustment. Inspect the condition of the tongs, gears and toothed racks. Check the operation of the tongs and inspect the tong dampers for wear.

3. Inspect all cable channels and conduits for wear. Check that all channels and conduits are secured to the frame. Inspect the condition of the table harness plug and its mounting bracket.

4. Check the adjustment on the stop collars. Inspect the swing shaft bearings for wear. Inspect the condition of the table spring. Inspect the condition and mounting of the table jam roller. Check the adjustment of the horizontal stop bolt.

5. Inspect the TS-1 jam switch mounting and adjustment. Check for loose or missing hardware and springs.

6. Inspect all pin holders and pin holder solenoids for correct mounting. Inspect all pin holder switches for tight mounting. Check all pin holder connectors and wiring for routing and connection. Inspect the adjustment on the pin detector plates.

7. Inspect the mounting of the table racks to the table. Check the adjustment and condition of the small roller support assembly. Check the condition of the T-stop. Check the mounting of the OOR actuator cam. Inspect the condition of the chain and pivot bearing.

Drive Frame Assembly

1. Inspect the welds and condition of the sweep shaft. Check the sweep shaft supports for secure mounting. Inspect the sweep shaft bearings for signs of wear. Inspect the connecting rods and verify all hardware is in place and secure.

2. Inspect the condition and welds on the left-hand and right-hand drive frame assemblies. Check for loose or missing hardware. Inspect all cable channels and cables for condition and routing. Check for any worn shaft bearings. Check the chain tensioners for condition and adjustment. Inspect the frame counter for correct operation.

3. Inspect the spotting tong drive for loose or missing hardware. Check for loose or worn gears. Check the spotting tong solenoid for proper operation. Check the spotting tong clutch for correct operation, and check the condition of the clutch shaft. Inspect the mesh between the square shaft drive gear and the spur gear. Check the condition of the square shaft drive gear.

4. Inspect the motors for correct mounting and alignment. Check the condition of all V-belts. Inspect the motor cables for correct routing. Check the condition of the motor tensioning springs. Check all motor mounting plate bushings. Check for excessive vibration in motor and belt operation.

5. Inspect the stroke limiter for a bent or cracked plate and loose or missing hardware. Check the mounting of the stroke limiter shock absorber. Check the condition of the rubber bumper. Check the solenoid for proper operation. Inspect the square shaft, the linkage and the square shaft latch for correct adjustment.

6. Inspect the condition of the double V-belts. Check for loose or missing tensioner mounting hardware. Check the tensioner shaft and bearings for loose or noisy operation.

7. Inspect the condition of the setting table and sweep motor drive assemblies. Check for worn or damaged chains. Check for loose or missing bearing plate hardware. Inspect the condition of bearing plate bearings and drive sprocket shafts.

8. Inspect the condition of the guide tower assembly. Check the mounting and adjustment on the TS-2 and OOR switch. Check for correct switch cable mounting. Check for loose or missing guide tower hardware. Inspect the condition of the lift chain sprocket. Check the condition of the jam lever and spring.

9. Inspect the sweep and table drive shaft assemblies. Check for shaft wear. Check for chain wear and proper tensioning. Inspect the crank arms and verify they are secure on the shafts. Check the sprockets for wear.

10. Inspect the switch cluster. Check the switch cluster housing to make sure it is secure. Check the adjustment on the "A," "B," "C," and "D" switches. Check the adjustment on the switch cam.

Electrical

1. Inspect the electrical box and box mounting hardware. Check the ground strap and verify that it is in place and secure. Verify that all cables are routed correctly. Inspect the box cover to verify it is in place and secure. Are all box switch guards in place? Check all cable and box connectors for correct seating.

2. Inspect the ball detect and reflector. Check and verify all mounting hardware is secure. Check the ball detector assembly for proper adjustment.

3. Inspect the ball rack reset button. Check for correct operation and check the cable routing and connection.

4. Verify the functionality of all safety interlock switches and sensors and other safety related equipment.

Power Ball Lift

1. Check the condition and mounting of the ball lift tires. Check the condition of the lift tire shafts and bearings. Check the condition and operation of the ball lift clutch.

2. Check the ball lift motor for correct mounting. Check the motor pulley for proper alignment. Check the drive belt condition and alignment.

3. Check the ball lift tracks for correct mounting. Check the condition of the rubber and leather tracks and verify they are secure.

Administration and Organization

1. Is a spare parts and inventory control system in place? Are adequate spare parts on hand and are those parts organized and accessible? Check for inventory control.

2. Verify that the correct hand tools are in place. Are the hand tools organized for ready access?

3. Verify that the correct cleaning and lubrication supplies are on hand. Check and verify the supplies are adequate and that the correct approved materials are in use.

4. Is a preventive maintenance program in use? Is a lubrication program in use? Is a cleaning program in use?

5. Verify that current operations manuals, service parts manuals and service bulletins are in the center.

6. Verify that stop sheets, recap forms and frames per stop data is being used in the center.

Main Frame Assembly

1. Inspect the main frame. Check for wear points or broken welds. Check for loose or missing hardware. Check the main support braces and verify they are secure.

2. Inspect the pinlight fixture. Check and verify that the fixture is secure. Check the lamp and lamp sockets. Check the power cord routing.

3. Inspect the guards. Check for wear points. Check for loose or missing hardware. Check for any missing guards. Check the work platform and the work platform braces and hardware.

Distributor Assembly

1. Inspect the distributor frame assembly. Check for worn or damaged frame components and welds. Check for loose or missing hardware. Check and verify that the dust pan is secure. Check the distributor rails and extensions for wear or cracks. Check the distributor stations for wear or cracks. Inspect the lower pin guides for bent or missing parts. Check the corner turn rails and corner pin turn devices for loose or missing hardware and for correct adjustment.

2. Inspect the distributor shafts, pulleys and belting. Check for worn or damaged shafts or bearings. Check for worn or cracked pulleys. Inspect the condition of the distributor belting. Check the condition of distributor gears and verify proper gear mesh. Check the alignment of all shafts, pulleys and belting. Check for any missing shaft, bearing or pulley hardware.

3. Inspect the distributor pin stations. Verify all pin stops are in place. Check the pin sliders for free operation. Check the pin sliders for cracks or breaks. Check for loose or missing pin station hardware. Check the ejector flaps for wear or cracking. Check the retaining bows for wear or cracking. Check for worn, cracked or misadjusted pin release levers. Verify that all pin station springs are in place. Inspect the top and bottom housings for cracks or wear.

GS-Series Pinsetter Preventive Maintenance Inspection Checklist

Center Name _____ **Lane #** _____

Mechanic Name _____ **Date** _____

Inspection Period	1	2	3	4	Inspection Period	1	2	3	4
TRANSPORT BAND ASSEMBLY					**SWEEP WAGON ASSEMBLY**				
1. Hardware / Side Frames / Boards					1. Sweep Wagon Frame / Guide Rollers				
2. T-Band Board / Carpet / Rollers					2. Sweep Board / Adapters / Board Felt				
3. T-Band Drive Belts / Pulleys					3. Sweep Release / Attenuator / Hydraulic				
4. T-Band Track Tension					4. Sweep Position / Switch SM + G				
BALL CUSHION / PIT CURTAIN					**DRIVE FRAME ASSEMBLY**				
1. Cushion Board / Frame / Hardware					1. Distribution Drive Assembly				
2. Shock Absorbers / Rubber Bumper					2. Sweep Drive Assembly				
3. Overflow / Chutes / Socks					3. Table Drive Assembly				
4. Pit Curtain					4. Motors / Belts / Motor Mountings				
BALL ACCELERATOR ASSEMBLY					5. Stroke Limiter Assembly / Hydraulic				
1. Frame / Welded Assemblies / Hardware					6. Out Of Range Function (OOR Switch)				
2. Door Protector Wedges					**ELECTRICAL COMPONENTS**				
3. Motor / Flat Belt / Drum					1. Boxes / Mounting Hardware				
ELEVATOR ASSEMBLY					2. Ball Detector / Reflectors				
1. Frame/Welded Assemblies					3. Ball Rack Reset Button				
2. Chains / Shovels					**POWER BALL LIFT**				
3. Feed / Centering Deflectors					1. Ball Lift Tires				
4. Damper Plate / Rubber Bumpers					2. Motor / Drive Belt				
5. Elevator (EC) Switch					3. Ball Lift Tracks				
6. Shark / Pin Guide Wedges					**ADMINISTRATION AND ORGANIZATION**				
7. Pin Count Switch (SSW)					1. Spare Parts / Inventory Control				
8. Round Belt / V-Belt					2. Tools / Maintenance Equipment				
DISTRIBUTOR FRAME					3. Cleaning / Lubrication Supplies				
1. Frame / Welded Assemblies					4. Preventive Maintenance Program				
2. Shafts / Pulleys / Belting					5. Manuals and Service Bulletins				
3. Pin Separators / Centering Devices					6. Stop Sheets / Recap Forms				
SETTING TABLE ASSEMBLY					**MAIN FRAME ASSEMBLY**				
1. Frame / Welded Assemblies					1. Frame / Welded Assemblies				
2. Spotting Tongs / Geared Racks / Switch ST					2. Pin light Fixture				
3. Table Harness / Cable Channels					3. Guards / Work Platform				
4. Swing Shafts / Connecting Rods									
5. Table Jam Switches TS-1 / TS-2									
6. Pin Holders / Pin Switches / Detect Plates									
7. Setting Table Guide Bearings / Rollers									
8. Table Positions / Top / Detect / Down									
9. Table Gear / Lift and Drive Trains									
10. Parallel Drive									
11. Spotting Tong Cam Cluster									

Detailed Maintenance Schedule

The following explains the maintenance items that should be included on the bowling center's work schedule. Some items should be done on a fixed schedule regardless as to the number of pinsetters in the center. Scheduling for other tasks are based on the number of pinsetters, their frequency of use, the environment that the machines are operating in, and in some cases the type and amount of lane conditioner being used.

Variable Schedule Items

1. **Pinsetter Cleaning - Completely Clean the Pinsetter Once Per Month.**
   Developing a procedure in which you remove the dirt and loose particles from a machine has two benefits. First it keeps the pinsetter free of dirt and second, it also causes the person doing the cleaning to look over the entire machine. This allows this person to notice loose or worn parts, welds that are cracking or any other problem that can be fixed before it causes a machine down situation.

2. **Clean Pins - Once Per Week**
   Cleaning the pins with pin cleaner regularly will extend the useful life of the pins, keep the machine clean, and promote better pin movement within the pinsetter..

Fixed Schedule Items

Daily Maintenance

3. **Check Stop Sheets for Each Pinsetter and Make necessary corrections**

4. **Troubleshoot, Repair or Adjust all Reported Failures**

5. **Check the Position of Each Transport Band; Adjust as Needed**
   Make sure the bands are centered on the rollers.

6. **Check the Pin Feed Deflectors for Proper Clearance Above the Transport Band**

Weekly Maintenance

7. **Clean Shark Switch Pin Guide Assemblies**
   The shark switch pin guide wedges must be cleaned with a general purpose cleaner to prevent lane oil and dirt from causing pin jams.

8. **Pin Wipes and Overflow Chutes**
   Wash in warm water or 12:1 diluted lane cleaner such as Invincible.

9. **Clean the Entire Transport Band with a 12:1 diluted lane cleaner such as Invincible**

10. **Check for Worn "V" Belts That Are Cracked, Split or Causing Motors to Bounce**
    Wipe the belts with a dry cloth while inspecting them. Especially note the condition of the table motor drive belt. Failure of this belt will cause a sudden dropping of the table which can result in severe machine damage and possible personal injury.

11. **Check All Green Belts for Proper Tension**
    Check for squealing, slipping or sagging belts. Replace or resize as necessary.

12. **Check All Hydraulic Shock Absorbers for Leakage; Verify Proper Operation**

13. **Check the Overflow Socks for Wear and Proper Alignment**

14. **Check the Ball Door Locking Mechanism for Proper Operation**

Monthly Maintenance

15. **Clean the Front of the Ball Cushion Pit Curtain, and Pinfeed Deflectors with a General Purpose Cleaner**

16. **Check and Tighten All Fastening Screws on the Transport Band Boards**

17. **Examine the Setting Table Cable Conduits for Damage**

18. **Clean Distributor Belts with 12:1 diluted lane cleaner (Invincible).**

19. **Clean the Overflow Socks with Basic laundry Detergent**

20. **Lubricate All Items Listed in the Monthly Section of the Lubrication Schedule**

Quarterly Maintenance

21. **Clean the Ball Detect Lens and Reflectors and Tighted Mounting Hardware**
    Clean only with a glass cleaner that will not harm plastics.

22. **Check the Drive Gears, Pinions and Pulleys of the Sweep and Table for Wear**

23. **Clean the Sweep Tracks and Check Sweep Wagon Guide Rollers Check for Proper Operation**

24. **Check Table Rack Guide Roller and Tube Guide for Proper Tightness and Operation**

25. **Check the Overflow Chutes for Signs of Wear or Loose Hardware**

26. **Check and Tighten All Pin Holder Mounting Hardware**

27. **Check and Adjust the Tension of the Table and Elevator Motor Drive Chains**

28. **Check the Distributor's Bearings, Shafts and Drive Pulleys for Signs of Wear**

29. **Tighten the Mounting Bolt and Check the Key and Pivot Bearing for the Table Shaft's Crank Arm Lubricate the Pivot Bearing**

30. **Check Switch Cluster Cam Timing**

31. **Check the Sweep Release Assembly and Pivot Bearing for Wear, Cracks and Proper Operation**

32. **Check All Distributor Hardware for Tightness**

33. **Check the Ball Impact Protection Strips on the Ball Cushion Board**

34. **Lubricate All Items Listed in the Quarterly Section of the Lubrication Schedule**

Semi-Annual Maintenance

35. **Check the Adjustment and Hardware Connections for All Function Switches**

36. **Inspect the Ball Cushion Frame, Stop Collars and Bearings**

37. **Check and Tighten All Hardware on the Kickback and Accelerator Protector Plates**

38. **Inspect and Clean the Accelerator Belt, with General Purpose Cleaner. Examine the Accelerator Rails for Signs of Wear**

40. **Check and Tighten the Fastening Hardware on the Sweep Shaft Bearing Retainers**
    Failure to tighten can cause the sweep shaft to shift and the arms to hit the table.

41. **Check and Tighten the Sweep Arm Connecting Rods**

42. **Check and Adjust the Clearance Between the Sweep Track and Guide Rollers**

43. **Check the Stroke Limiter Assembly for Proper Operation and Verify Proper T-Stop Clearance At The Stroke Limiter Plate**

44. **Check the Pin Holder Swing Shaft Bushings**

45. **Check the Spotting Tong Toothed Racks and Gears**

46. **Check All Drive Frame Hardware for Tightness**

47. **Check All Elevator Hardware for Tightness**

48. **Lubricate All Items Listed in the Semi-Annual section of the Lubrication Schedule**

Annual Maintenance

49. **Tighten All Pit Curtain Support Bracket Bolts and Curtain Mounting Bolts**

50. **Check the Electronic Box Mounting Hardware**

51. **Check All Cabling for Signs of Stress and Wear**

52. **Check All Welded Assemblies for Signs of Breakage**

53. **Check All Pivot and Wear Points**

54. **Verify the Functionality of ALL Safety and Interlock Switches / Sensors and Emergency Stop Switches**

55. **Check and Tighten Mounting Hardware for ALL Pinsetter Guards. Replace Damaged Guards or Mounting Hardware.**

56. **Review the Safety Guidelines Listed in this Manual with All Personnel Working on or Around the GS-Series Pinsetters**

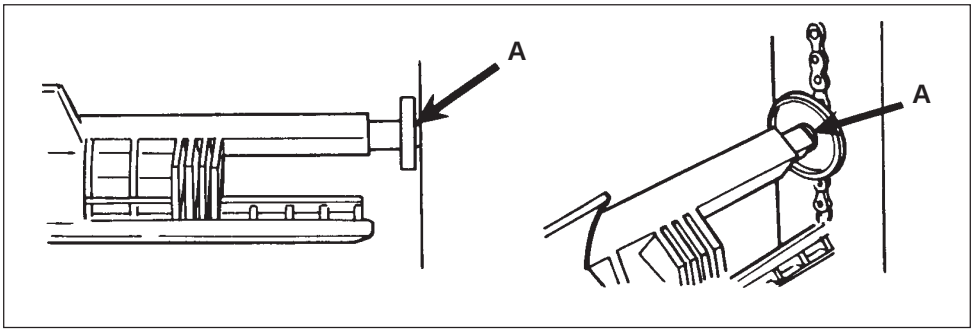
57. **Lubricate All Items Listed in the Annual Section of the Lubrication Schedule**

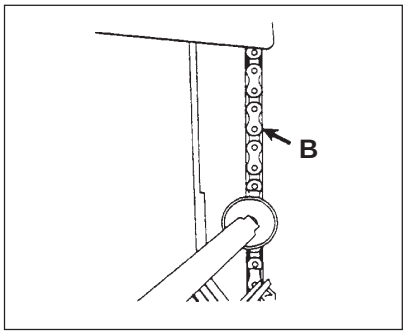
Monthly

Pin Shovel Shafts, Rollers and Elevator Chains

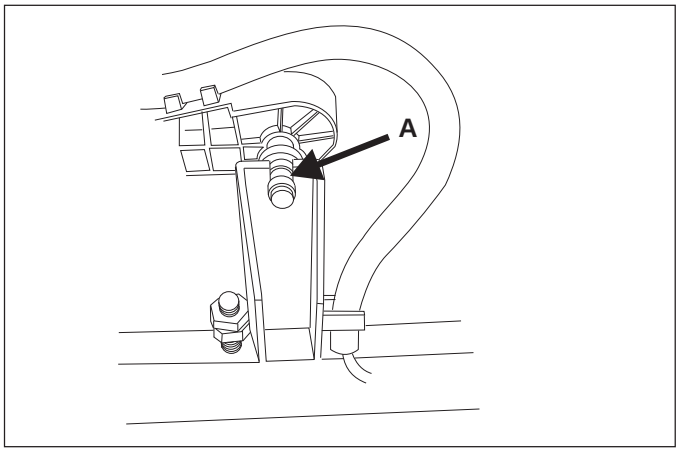
A. One drop of oil on each pivot point.

B. Put a light coating of chain lubricant on both chains.





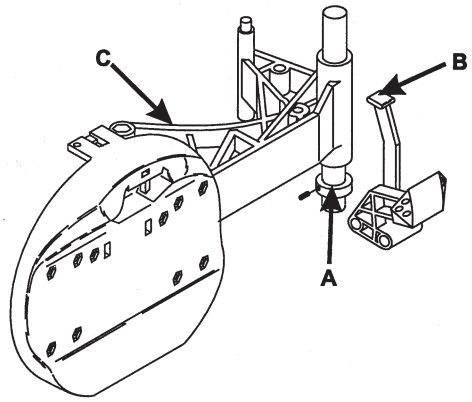
LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



Pin Holder Swing Shafts

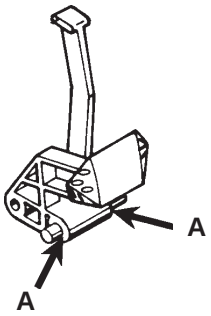
A. Swing Shaft - one drop of oil on the bushing at end of each of the four swing shafts.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



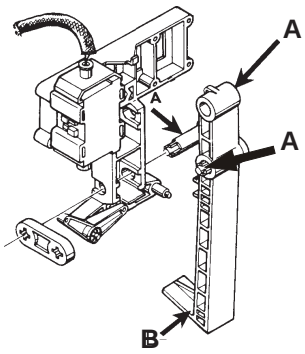
Ball Door

A.Shaft - one drop of oil on the shaft collar.
B.Latch - cover with a light film of grease.
C.Arms - cover with a light film of oil.



Ball Door Button Shaft

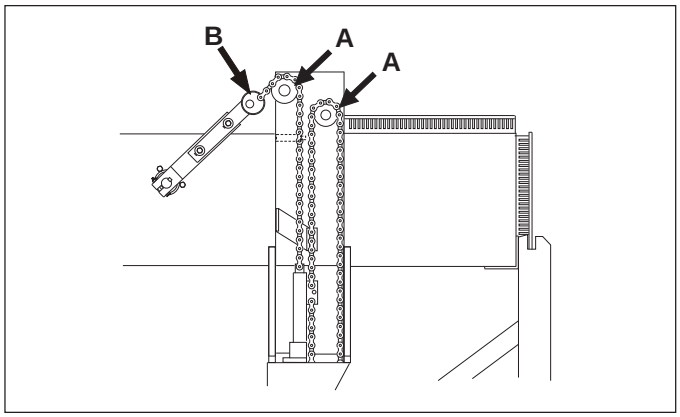
A.One drop of oil on each side of the shaft.



Ball Door Locking Mechanism

A. Connecting links need 1 drop of oil at each pivot point.
B. Bottom of locking bolt needs a light film of grease.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



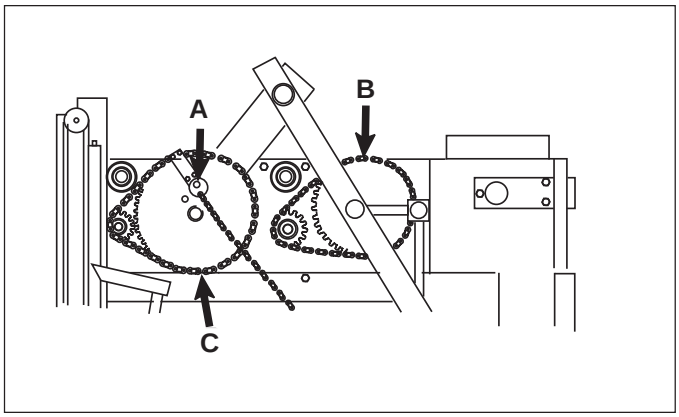
Setting Table Pinion Gears

A. Entire chain needs a light coating of chains lubricant.

B. One drop of oil on pivot bearing hub.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										

Quarterly



Drive Chains

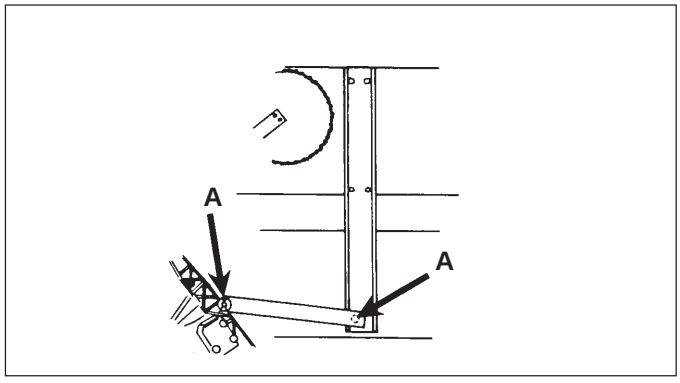
A. Table Shaft - a light coating of chain lubricant.

B. Sweep Shaft - a light coating of chain lubricant.

Sweep Release Chain

A. A light coating of chain lubricant.

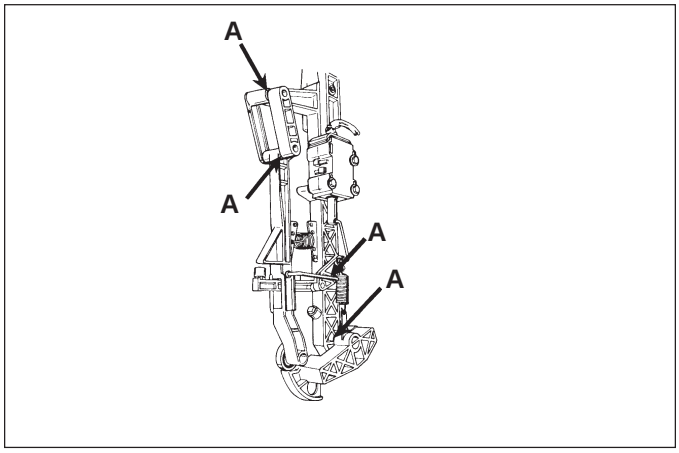
LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



Sweep Release Pivot Link

A. One drop of oil to both ends of the link.

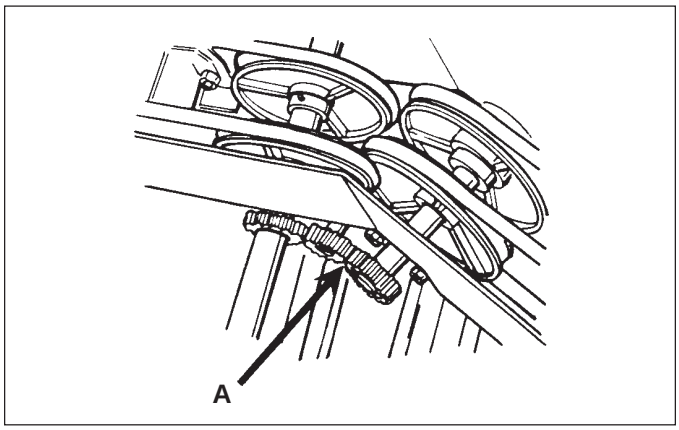
LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



Sweep Release Mechanism

A. One drop of oil on each pivot point.

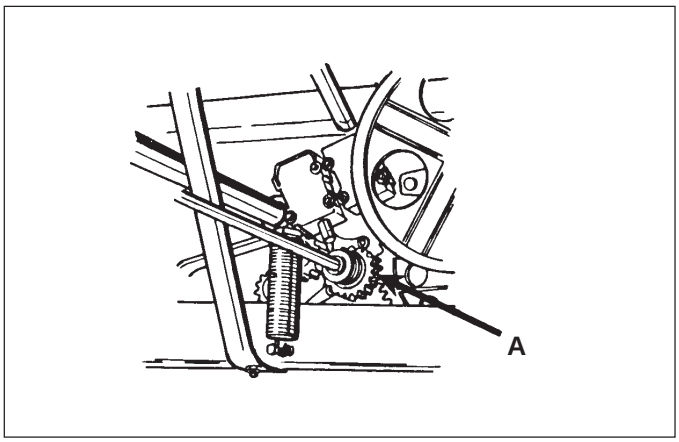
LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



Distributor Spur Gears

A. Grease both sets with a light film.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										

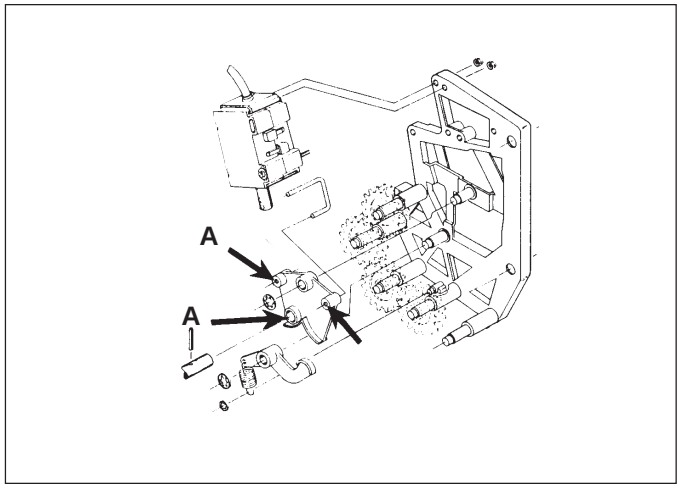


Spotting Tong Clutch Gear Cluster

A. Grease the gears lightly.

NOTE: *Do not allow grease to get into the clutch mechanism.*

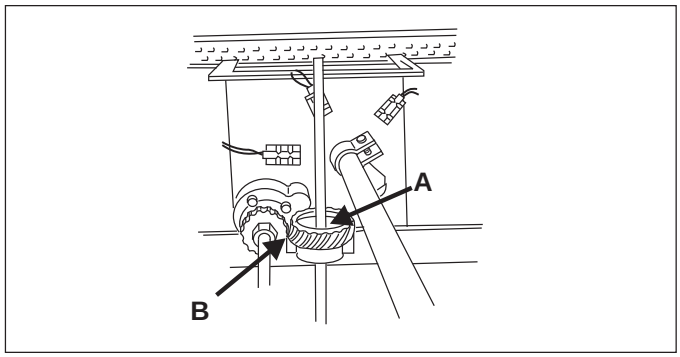
LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



Gear Cluster Pivot Lever Plate

A. Apply one drop of oil to each pivot point.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										

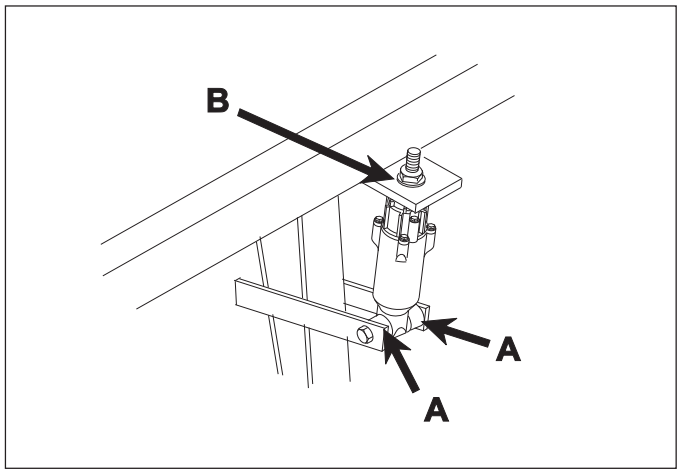


Spotting Tong Square Shaft and Bevel Gears

A. Apply a light film of grease on the entire travel area of the square shaft.

B. Apply a light film of grease on both bevel gears.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										

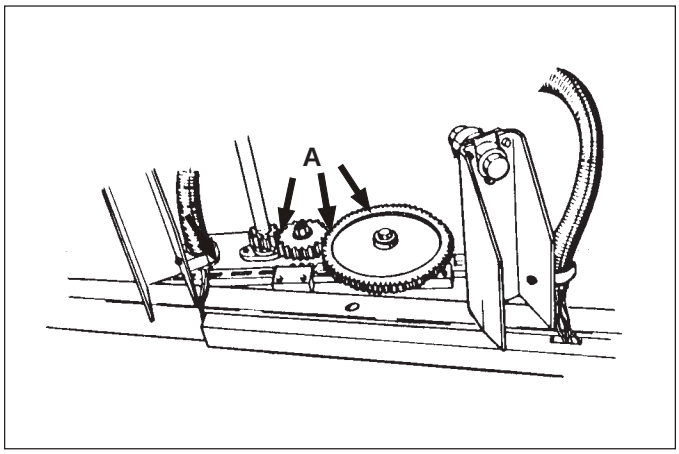


Hydraulic Shock Absorber Bushing

A. One drop of oil each side of the bushing.

B. One drop of oil on spacer.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



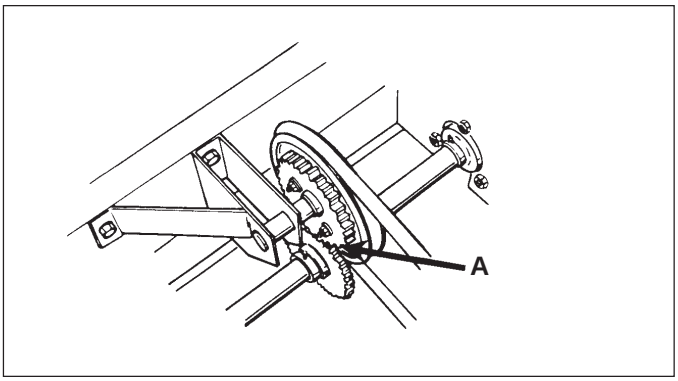
Spotting Tong Drive Gears

A. Apply a light film of grease on all four gears

NOTE: *There is a small gear located under the largest gear.*

NOTE: *You should always remove the old grease and dirt before applying new grease.*

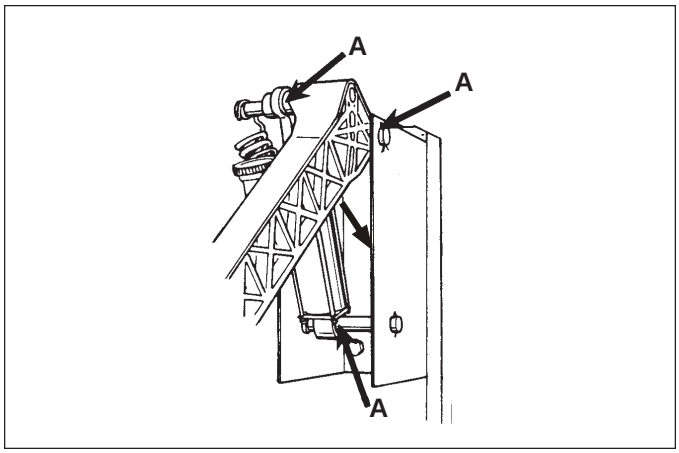
LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



Front Distributor Shaft and Idler Gears

A. Apply a light film of grease on both gears.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



Sweep Attenuator

A. Apply one drop of oil to each pivot point.

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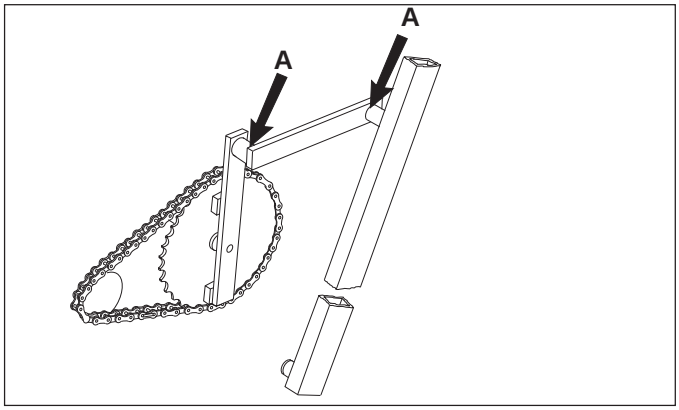
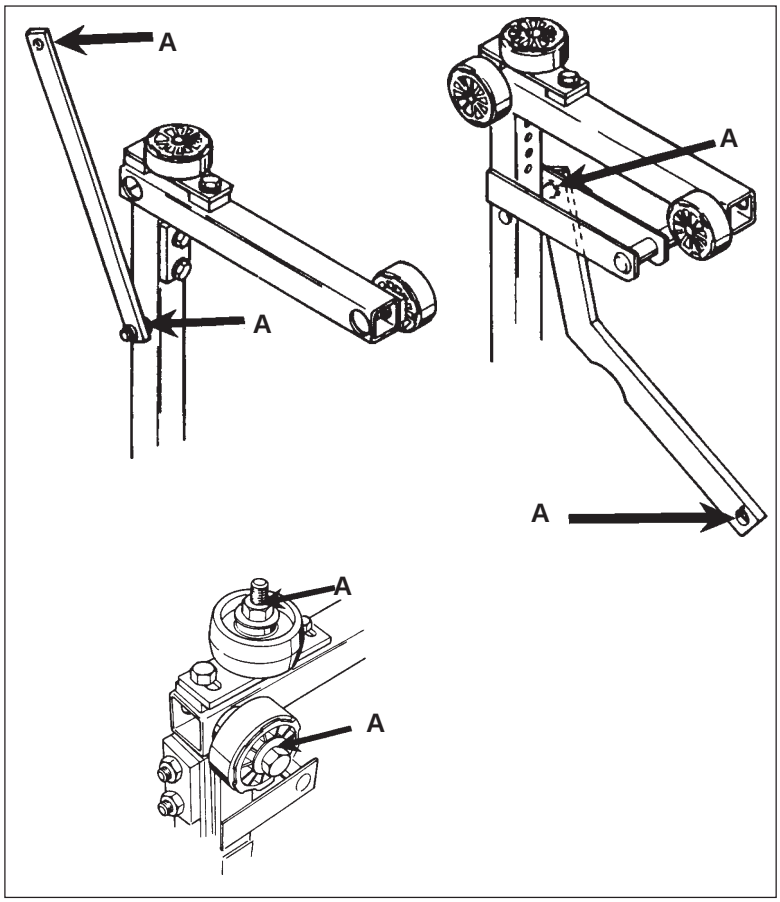
LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



Sweep Drive's Bushings

A. Apply one drop of oil to each bushing.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



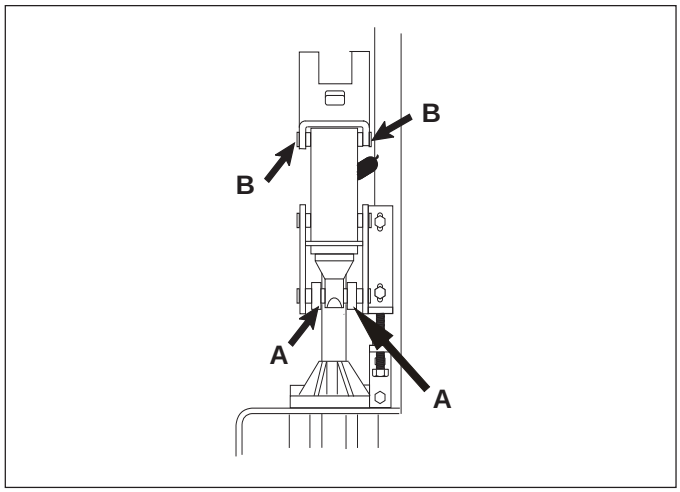
Sweep Wagon Link Bearings

A. Apply one drop of oil to each pivot point.

Sweep Wagon Roller Shafts

A. Apply one drop of oil to each of the six shafts.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										

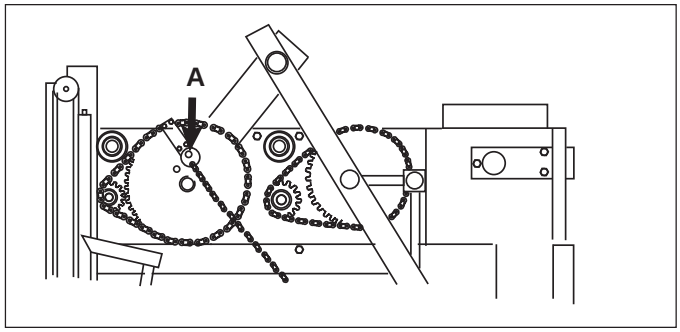


Stroke Limiter Shock Absorber

A. Apply one drop of oil to each stop collar on the lower mounting shaft.

B. Apply one drop of oil to each bushing on the stroke limiter block.

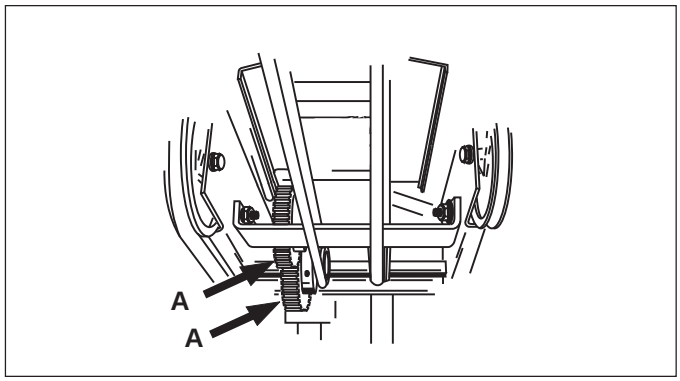
LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



Sweep Release Pivot Bearing

A. Apply one drop of oil to the pivot bearing hub.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										

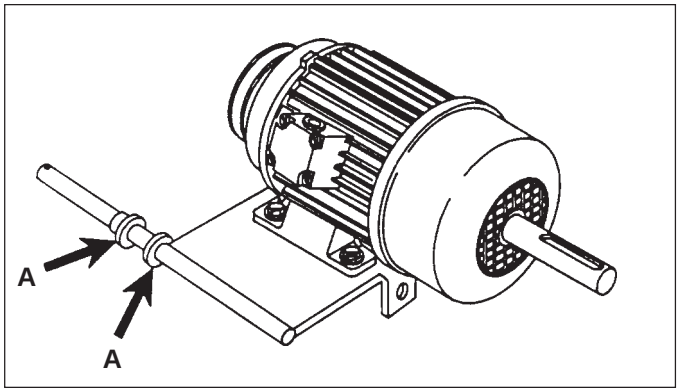


Shark Switch Gears

A. Apply a light film of grease to both gears.
B. One drop of oil on the Shark Fin slide and pivot.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										

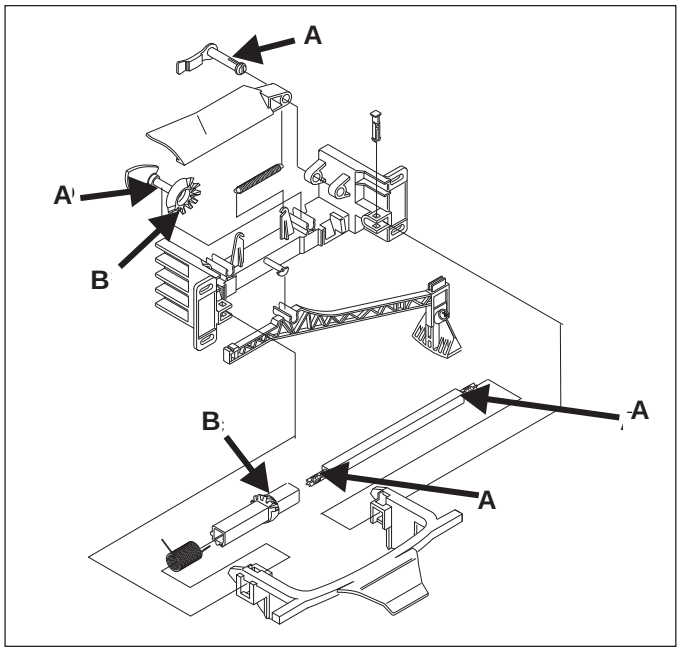
Semi-Annual



Motor Mounting Brackets Shafts

A. Apply two drops of oil to each bushing on the shafts.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										

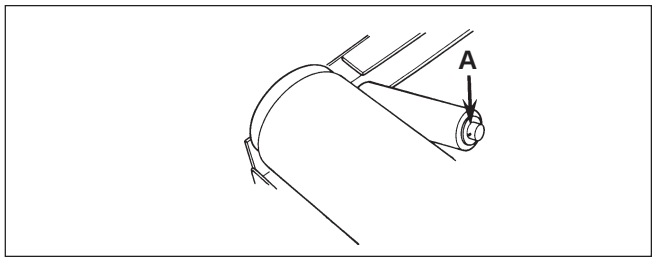


Pin Station Assembly

A. Apply one drop of oil to pivot point.

B. Apply a light film of grease to the bevel gears.

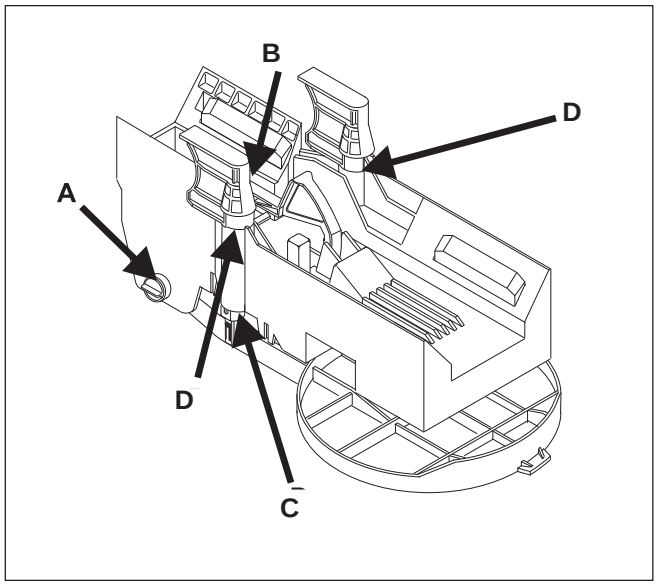
LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



Transport Band Frame Rollers

A. Remove the rollers from their shafts and grease the entire shaft.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



Pin Holders

A. Apply one drop of oil to each end of the pin
detector plate's pivot.

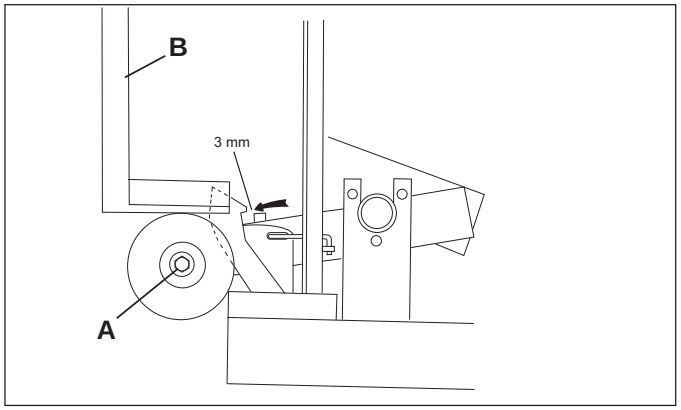
B. Apply one drop of oil to the switch finger.

C. Apply light film of grease on both gripper drive teeth.

D. Apply one drop of oil to pin gripper pivot point.

NOTE: *Never apply any type of lubricant to the solenoid or its plunger. When a plunger becomes dirty or sticky, it must be cleaned with electrical contact cleaner and them dried to leave no residue.*

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										

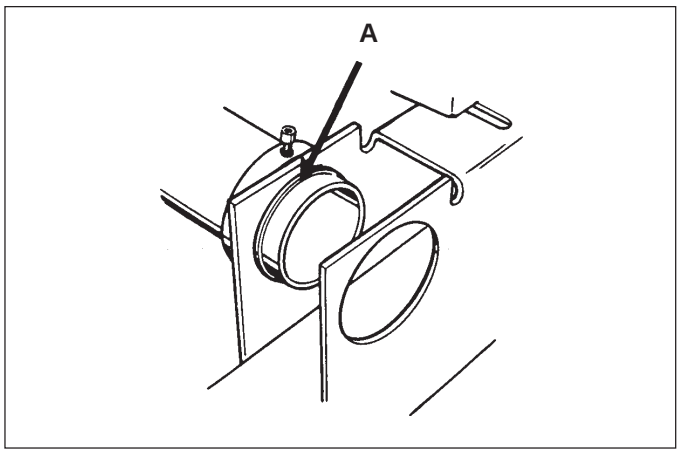


Setting Table Swing Shaft Roller

A. Apply one drop of oil to the shaft on each side of the roller.

B. Apply a light film of grease along the actuator arm.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



Ball Cushion Bushings

A. Grease on installation.
(Check for wear, replace as needed)

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										

Maintenance Forms

The following pages contain forms to be used in conjunction with maintenance on the Brunswick GS-Series Pinsetters.

GS-Series Stop Sheet			Machine No. _____	
Date	Frame Count	Error Code	Corrective Action	Mech. Initials

Error Codes

Std. Code	Extended Code	
P0	Pin OOR	Out-of-Range
01	Pin1 Ld	Pin Loading Time Out Pin 1
02	Pin2 Ld	Pin Loading Time Out Pin 2
03	Pin3 Ld	Pin Loading Time Out Pin 3
04	Pin4 Ld	Pin Loading Time Out Pin 4
05	Pin5 Ld	Pin Loading Time Out Pin 5
06	Pin6 Ld	Pin Loading Time Out Pin 6
07	Pin7 Ld	Pin Loading Time Out Pin 7
08	Pin8 Ld	Pin Loading Time Out Pin 8
09	Pin9 Ld	Pin Loading Time Out Pin 9
10	Pin10 Ld	Pin Loading Time Out Pin 10
50	Detect10	#10 Pin Not Detected in Diagnostics
51	Detect1	#1 Pin Not Detected in Diagnostics
52	Detect2	#2 Pin Not Detected in Diagnostics
53	Detect3	#3 Pin Not Detected in Diagnostics
54	Detect4	#4 Pin Not Detected in Diagnostics
55	Detect5	#5 Pin Not Detected in Diagnostics
56	Detect6	#6 Pin Not Detected In Diagnostics
57	Detect7	#7 Pin Not Detected in Diagnostics
58	Detect8	#8 Pin Not Detected in Diagnostics
59	Detect9	#9 Pin Not Detected in Diagnostics
60	A Found	Switch A is Not Expected But Found
61	B Found	Switch B is Not Expected But Found
62	C Found	Switch C is Not Expected But Found

Std. Code	Extended Code	
63	D Found	Switch D is Not Expected But Found
64	SMFound	Switch SM is Not Expected But Found
65	G Found	Switch G is Not Expected But Found
66	STFound	Switch ST Is Not Expected But Found
67	OORFound	SW. OOR is Not Expected But Found
70	A Ntfnd	Switch A Expected But Not Found
71	B Ntfnd	Switch B Expected But Not Found
72	C Ntfnd	Switch C Expected But Not Found
73	D Ntfnd	Switch D Expected But Not Found
74	SM Ntfnd	Switch SM Expected But Not Found
75	G Ntfnd	Switch G Expected But Not Found
76	STNtfnd	Switch ST Expected But Not Found
90	Invld 0	Invalid Machine State 0
91	Invld 1	Invalid Machine State 1
92	Invld 2	Invalid Machine State 2
93	Invld 3	Invalid Machine State 3
94	Invld 4	Invalid Machine State 4
95	Invld 5	Invalid Machine State 5
EJ	ElevJam	Elevator Jam
EL	Pin Cnt	Pin Count Switch Shorted for 5 Seconds
J1	TS1 Jam	Jam Switch TS1
J2	TS2 Jam	Jam Switch TS2 (Tower)
	BA	Accelerator Motor (overload)
	IL	Interlock Switch Open
	PF	Power Failure Has Ocured

GS-Series Pinsetter Weekly Report

Center Name _____ Week Ending _____

	Daily Frame Totals								
	Daily Stop Totals								
Error Code	Description	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Total
01	Pin 1 - Time Out or Jam								
02	Pin 2 - Time Out or Jam								
	Pin 3 - Time Out or Jam								
04	Pin 4 - Time Out or Jam								
05	Pin 5 - Time Out or Jam								
06	Pin 6 - Time Out or Jam								
07	Pin 7 - Time Out or Jam								
08	Pin 8 - Time Out or Jam								
09	Pin 9 - Time Out or Jam								
10	Pin 10 - Time Out or Jam								
*11	Pin Jam - Left-Hand Corner								
*12	Pin Jam - Right-Hand Corner								
*13	Pin Jam - Left Distributor Lane 1								
*14	Pin Jam - Left Center Distributor Lane 2								
*15	Pin Jam - Right Center Distributor Lane 3								
*16	Pin Jam - Right Distributor Lane 4								
*17	Pin Jam - Shark Switch								
*18	Pin Jam - Pin Guide Wedges								
*19	Pin Jam - Pin Head First								
*20	Pin Stuck in Elevator								
*21	Pin Under Pin Feed Deflector								
*22	Pin in Ball Accelerator								
*23	Ball Stuck in Pit								
*24	Ball Stuck in Ball Lift								
*25	Pin Blocking Ball Door								
*26	Pin Jammed in Setting Table								
*27	Spotting Tongs Jammed								
*28	Sweep Roller Not in Slot								
*29	Belt Broken								
*30	Belt Loose								
*31	Overflow Chute / Sock Jam #7 Pin Side								
*32	Overflow Chute / Sock Jam #10 Pin Side								
*50	Pin Holder Switch Malfunction								
60	Switch A Not Expected but Found								
61	Switch B Not Expected but Found								
62	Switch C Not Expected but Found								
63	Switch D Not Expected but Found								
64	Switch SM Not Expected but Found								
65	Switch G Not Expected but Found								
66	Switch ST Not Expected but Found								
67	Switch OOR Not Expected but Found								
70	Switch A Expected but Not Found								
71	Switch B Expected but Not Found								
72	Switch C Expected but Not Found								
73	Switch D Expected but Not Found								
74	Switch SM Expected but Not Found								
75	Switch G Expected but Not Found								
76	Switch ST Expected but Not Found								
90	Invalid Machine State 0								
91	Invalid Machine State 1								
92	Invalid Machine State 2								
93	Invalid Machine State 3								
94	Invalid Machine State 4								
95	Invalid Machine State 5								
98	Electronic Box Failure								
99	Part Broken / Other (Explain on Back)								
EJ	Elevator Jam								
EL	Pin Count Switch Failure								
J1	Jam Switch TSI								
J2	Jam Switch TS2 (Tower)								
PO	Out-of-Range								

**These code numbers are not displayed by the Pinsetter CPU LED display.*
Explain problems or irregularities on the back of this report.

GS-Series Pinsetter Monthly Report

Center Name _____ Month_____ Date_____					
	Daily Frame Totals				
	Daily Stop Totals				
Error Code	Description	Week 1	Week 2	Week 3	Week 4
01	Pin 1 - Time Out or Jam				
02	Pin 2 - Time Out or Jam				
03	Pin 3 - Time Out or Jam				
04	Pin 4 - Time Out or Jam				
05	Pin 5 - Time Out or Jam				
06	Pin 6 - Time Out or Jam				
07	Pin 7 - Time Out or Jam				
08	Pin 8 - Time Out or Jam				
09	Pin 9 - Time Out or Jam				
10	Pin 10 - Time Out or Jam				
*11	Pin Jam - Left-Hand Corner				
*12	Pin Jam - Right-Hand Corner				
*13	Pin Jam - Left Distributor Lane 1				
*14	Pin Jam - Left Center Distributor Lane 2				
*15	Pin Jam - Right Center Distributor Lane 3				
*16	Pin Jam - Right Distributor Lane 4				
*17	Pin Jam - Shark Switch				
*18	Pin Jam - Pin Guide Wedges				
*19	Pin Jam - Pin Head First				
*20	Pin Stuck in Elevator				
*21	Pin Under Pin Feed Deflector				
*22	Pin in Ball Accelerator				
*23	Ball Stuck in Pit				
*24	Ball Stuck in Ball Lift				
*25	Pin Blocking Ball Door				
*26	Pin Jammed in Setting Table				
*27	Spotting Tongs Jammed				
*28	Sweep Roller Not in Slot				
*29	Belt Broken				
*30	Belt Loose				
*31	Overflow Chute / Sock Jam #7 Pin Side				
*32	Overflow Chute / Sock Jam #10 Pin Side				
*50	Pin Holder Switch Malfunction				
60	Switch A Not Expected but Found				
61	Switch B Not Expected but Found				
62	Switch C Not Expected but Found				
63	Switch D Not Expected but Found				
64	Switch SM Not Expected but Found				
65	Switch G Not Expected but Found				
66	Switch ST Not Expected but Found				
67	Switch OOR Not Expected but Found				
70	Switch A Expected but Not Found				
71	Switch B Expected but Not Found				
72	Switch C Expected but Not Found				
73	Switch D Expected but Not Found				
74	Switch SM Expected but Not Found				
75	Switch G Expected but Not Found				
76	Switch ST Expected but Not Found				
90	Invalid Machine State 0				
91	Invalid Machine State 1				
92	Invalid Machine State 2				
93	Invalid Machine State 3				
94	Invalid Machine State 4				
95	Invalid Machine State 5				
98	Electronic Box Failure				
99	Part Broken / Other (Explain on Back)				
EJ	Elevator Jam				
EL	Pin Count Switch Failure				
J1	Jam Switch TS1				
J2	Jam Switch TS2 (Tower)				
PO	Out-of-Range				

**These code numbers are not displayed by the Pinsetter CPU LED display.*
Explain problems or irregularities on the back of this report.

GS-Series Pinsetter Pending Items Work List

Center Name _____ **Lane #** _____

Mechanic Name _____ **Date** _____

Pending Work Item	Priority	Date Complete	Mechanic	Parts Used / Comments

Contents

Section 8: Servicing 8-3

Manually Raising or Lowering Setting Table 8-3

Changing Setting Table V-Belt 8-4

Setting Table Assembly Removal 8-4

Clearing Pins Jammed in Distributor 8-6

Stopping Machine in Mid-Cycle 8-6

Round Belt Repair and Replacement 8-7

Welding Round Belts 8-7

Changing Spotting Tongs 8-9

Spotting Tong Clutch And Shaft Removal Procedure 8-11

Spotting Tong Clutch and Shaft Reinstallation 8-12

Changing Motors 8-13

Motor Removal 8-13

Motor Pulley 8-14

Motor Pulley Removal 8-14

Motor Pulley Installation 8-14

Chain Repair or Replacement 8-17

Chain Repair 8-17

Chain Replacement 8-18

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Manually Raising or Lowering Setting Table

1. Turn off the main power switch on the Nexgen Controller and disconnect the incoming 3 phase power.

2. Remove all pins from the pin deck.

CAUTION: Never remove the V-belt with table in highest position or in a partially lowered position. The setting table uses the motor brake and V-belt for position holding. Table will fall to lowest position if belt is removed.

3. *Firmly grip* the top of the large table V-belt pulley. Refer to *Figure 8-1*.

(1) V-BELT
(2) LIFT MOTOR BEFORE ROTATING PULLEY

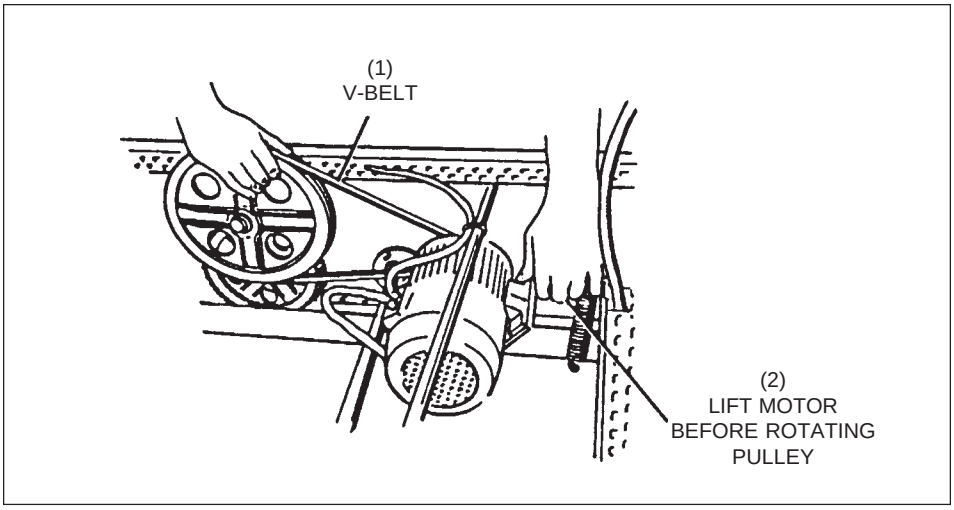

Figure 8-1. Manually Raising or Lowering the Setting Table.

4. Before rotating the pulley, use your other hand to lift the motor while carefully rotating the pulley. Watch the V-belt in the motor pulley. The belt must stay seated in both pulleys. DO NOT RELEASE YOUR GRIP ON THE V-BELT PULLEY.

5. *Lower the motor* so the V-belt holds (brakes) the table drive shaft *before* releasing your grip on the V-belt pulley .

6. Repeat this procedure until the desired height is obtained.

Changing Setting Table V-Belt

CAUTION: Never remove the V-belt with table in highest position or in a partially lowered position. The setting table uses the motor brake and V-belt for position holding. Table will fall to lowest position if belt is removed.

1. Turn the stop/run switch on the Nexgen Controller, Mechanic's rear control box, or mechanic's remote display to the stop position.

2. Manually lower the setting table to the new pin setting position. See previous page.

NOTE: *As an alternative, lower the table onto a jack-stand.*

3. Change the V-belt.

Setting Table Assembly Removal

1. Turn the main power switch at the Nexgen Controller to the off position and remove the input power cable from the box.

(1) 914 MM (3') LONG 1X4 SPACER
(2) SETTING TABLE

2. Place two 914 mm (3') long 1 x 4 spacers on the pin deck positioned so the deck will be supported front and back. Refer to *Figure 8-2.*

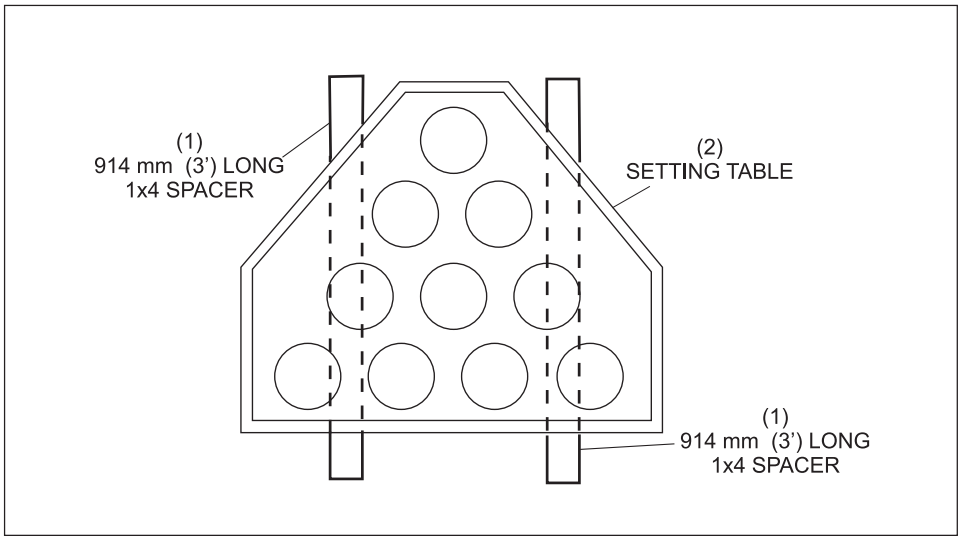

Figure 8-2. Placing Spacers.

3. Manually lower the setting table assembly so it is supported by the spacers. Refer to *Figures 8-1* and *8-2.*

4. Disconnect the setting table electrical cable and remove the cable from the support bracket. The support bracket can remain in place.

5. Remove the top section of the spotting tong square shaft and disconnect the lower section from the setting table.

5. Remove the top section of the stroke limiter / pin release square shaft. The lower section can remain in place.

(1) 24 MM NUTS
(2) DECK RACK TUBE
(3) SETTING TABLE STUDS

6. Remove the large pinholder vertical assist spring located on the front swing shaft.

7. Remove the four upper 24 mm nuts that secure the table to the deck rack tubes. Refer to *Figure 8-3*.

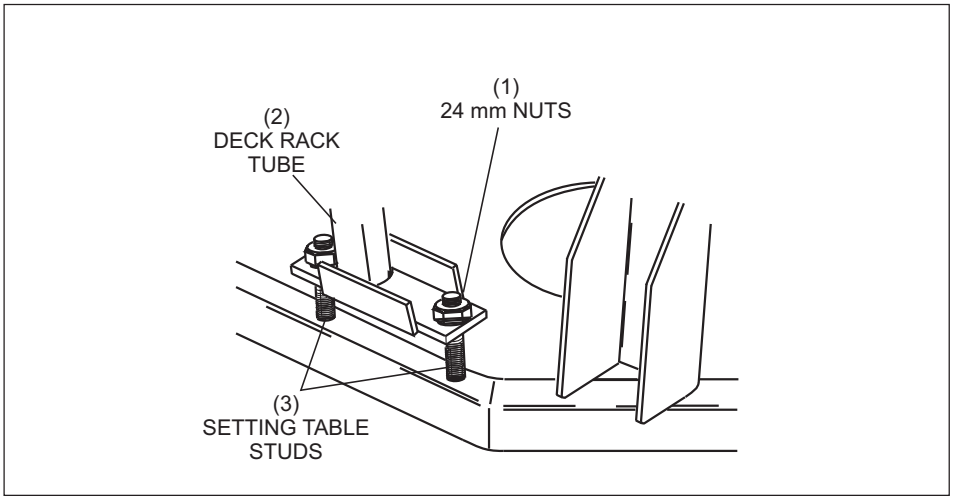

Figure 8-3. Removing Table from Deck Rack Tubes.

NOTE: *If the lower nuts are not moved, it makes leveling the reinstalled table quicker and easier.*

8. Manually rotate the setting table motor pulley clockwise to raise the deck rack tubes. Turning the motor pulley clockwise will cause the sweep release assembly to lift the sweep along with the table.

9 Rotate the pinholder to there horizontal position and allow them to lock in place..

10. Remove the setting table assembly from the pin deck area. As the back of the table approaches the front of the machine, lift the front of the table to gain clearance under the pinsetter frame.

9. Perform the necessary maintenance or repair.

10. To reinstall, reverse the removal procedure.

11. Level the table as needed using the 24 mm nuts.

Clearing Pins Jammed in Distributor

1. Turn the stop/run on the rear mechanic's box , Nexgen box, or mechanic's remote display to the stop position. If possible, turn off the main power switch on the Nexgen Controller box and remove the incoming 3 phase power.

2. Check for pins jammed at track ejector points. Check for pins jammed at belt turning points. Remove the jammed pins and place them on the outside return belt track.

3. Check the pin ejector assemblies for proper positions.

4. Continuous jams require checking the pin station assemblies for broken parts. Check pin release levers.

5. Apply power to the pinsetter.

6. Check pinsetter operation.

Stopping Machine in Mid-Cycle

A machine may be stopped in mid-cycle by turning the stop/run switch on the Nexgen Controller, mechanic's remote display, or mechanic's box to the stop position. Once power is restored to the pinsetter it will automatically return to home or ready to bowl position.

If internal service work is to be performed, turn off the main power switch and if possible, disconnect the incoming 3 phase power. Use an approved lockout device on the main power switch to prohibit the machine from being turned on.

NOTE: *Removing the incoming 3 phase power will disable both pinsetters. Upon completion of work, reconnect the 3 phase power, remove any installed lockout devices and turn the main power switch on.*

Once the machine has initialized, turn the stop/run switches to the run position. With older versions of GS firmware the machine will return to the "ready to bowl" position. With newer firmware a power fail (PF) error may be displayed. Clear the code by toggling both stop/run switches off then on.

Round Belt Repair and Replacement

The GS-Series pinsetter uses green polycord belts of various lengths to move pins through the transport band, elevator and distributor. These belts can stretch, become loose and slip on their pulleys. They can also crack and break as a result of a normal aging process.

If the belt stretches and becomes loose, a section of the belt may be cut out and it can be rewelded to the proper length. All belts with he exception of the transport band drive belt are 12 mm in diameter when new. Once the belt has stretched, cut, and rewelded several times, its diameter will be reduced. This will decrease its gripping power and effectiveness in handling pins. Belts with a diameter under 10 mm or showing cracks should be replaced to keep this area reliably handling pins.

Welding Round Belts

1. *Figure 8-4* gives nominal lengths of all distributor belts. The dotted lines represent belts that are not factory installed.

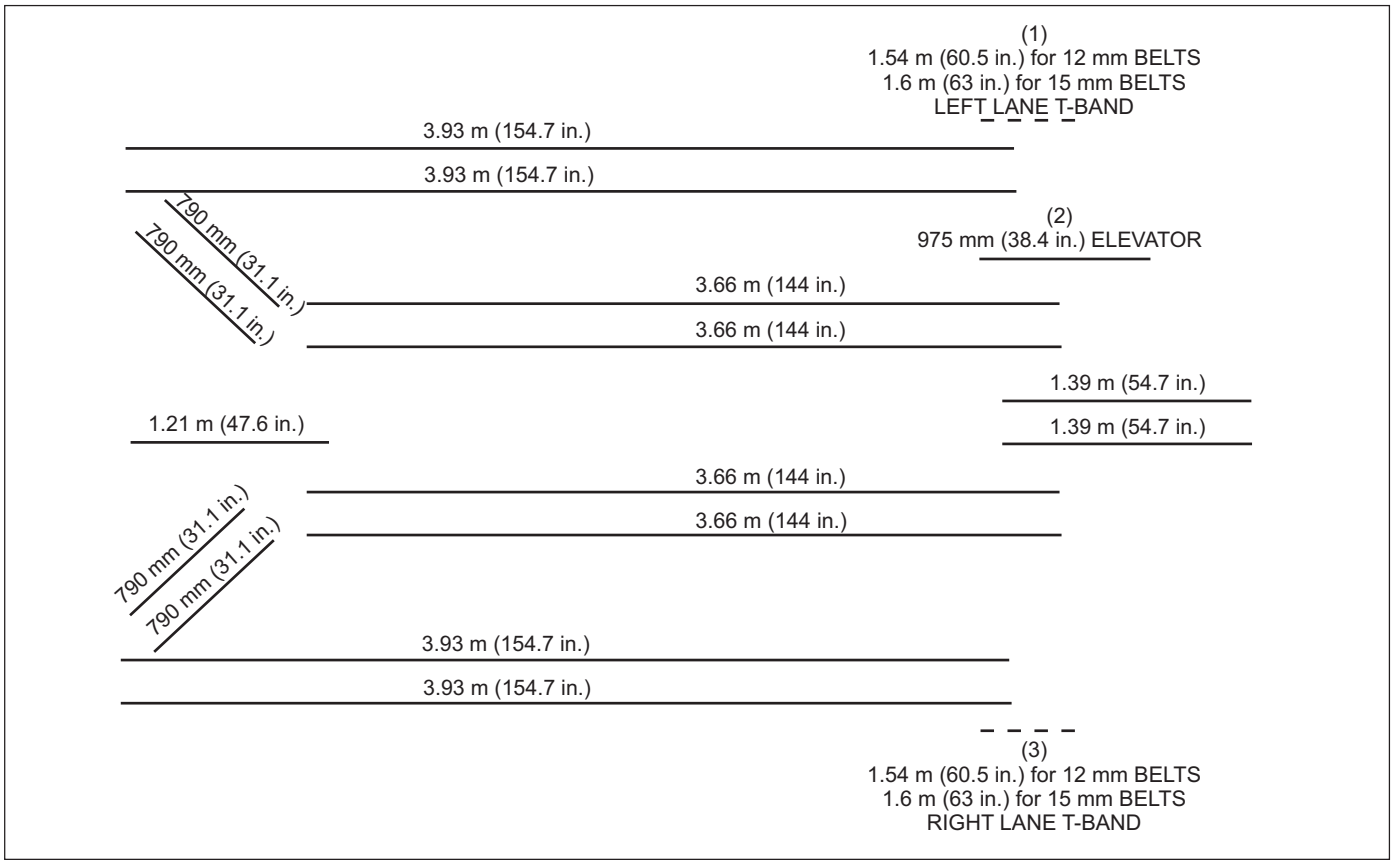
(1)
1.54 m (60.5 in.) for 12 mm BELTS
1.6 m (63 in.) for 15 mm BELTS
LEFT LANE T-BAND
3.93 m (154.7 in.)
3.93 m (154.7 in.)
790 mm (31.1 in.)
790 mm (31.1 in.)
(2)
975 mm (38.4 in.) ELEVATOR
3.66 m (144 in.)
3.66 m (144 in.)
1.39 m (54.7 in.)
1.21 m (47.6 in.)
1.39 m (54.7 in.)
3.66 m (144 in.)
3.66 m (144 in.)
790 mm (31.1 in.)
790 mm (31.1 in.)
3.93 m (154.7 in.)
3.93 m (154.7 in.)
(3)
1.54 m (60.5 in.) for 12 mm BELTS
1.6 m (63 in.) for 15 mm BELTS
RIGHT LANE T-BAND

Figure 8-4. Round Belt Lengths.

(1) 1.54 M (60.5 IN.) FOR 12 MM BELTS
1.6 M (63 IN.) FOR 15 MM BELTS
LEFT LANE TRANSPORT BAND

(2) 975 MM (38.4 IN.) ELEVATOR

(3) 1.54 M (60.5 IN.) FOR 12 MM BELTS
1.6 M (63 IN.) FOR 15 MM BELTS
RIGHT LANE TRANSPORT BAND

2. Cut off both ends of the belt neatly and vertical to the belt axis with the belt cutter found in your belt welding kit.

3. Pull the belt around the pulley shafts.

4. Place each belt end in the belt holder so they are *slightly* apart. Refer to *Figure 8-5*.

5. Push the soldering iron blade between the belt ends and bring them together heat the belt.

NOTE: *Both ends of the belt must be on the same axis on both sides of the blade.*

6. When a pad of melted polycord has formed, withdraw the soldering iron, and lightly tighten the knurling screws of the holder to bring the ends of the belt together. Refer to *Figure 8-5*.

7. Tighten the knurling screws to hold the belt together. Do not overtighten.

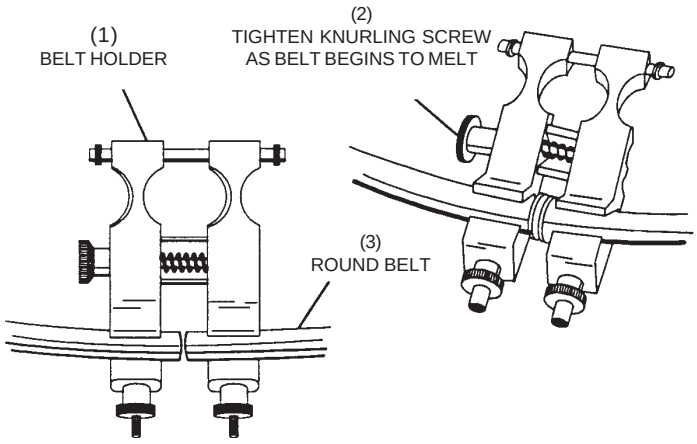

Figure 8-5. Welding Round Belts.

(1) BELT HOLDER

(2) TIGHTEN KNURLING SCREW AS BELT BEGINS TO MELT

(3) ROUND BELT

NOTE: *DO NOT OVERTIGHTEN. The melted polycord will be pushed out and the cold polycord left in the center will not form a weld.*

8. Allow to cool for approximately two minutes before removing the belt holder .

9. Trim the bead from around the belt with a sharp knife or single edge razor blade.

10. Wait another 5-10 minutes for the belt to cool

11. Install the belt onto the pulleys.

Changing Spotting Tongs

If a spotting tong becomes damaged and needs to be removed for repair, use the following procedure.

1. Turn the stop/run switch on the mechanic's control box or mechanic's remote display to the stop position. (Disconnect main power to the pinsetter if you will be leaving the machine unattended.)

2. Manually lower the setting table onto a jack stand or other suitable support.

NOTE: *If suspending the setting table on the stroke limiter plate, it must still be supported by a jack stand or some means of support to prevent the table from dropping if the stroke limiter is bumped or slips.*

3. Turn the spotting tong square shaft until the spotting tongs are completely closed . The "ST" switch should be open and the closed stop should be against the stop block. Refer to *Figure 8-6*.

(1) CLOSED STOP
(2) OPEN STOP
(3) GEAR RACK
(4) OPEN ST SWITCH
(5) RIGHT-HAND SQUARE SHAFT
(6) STOP BLOCK

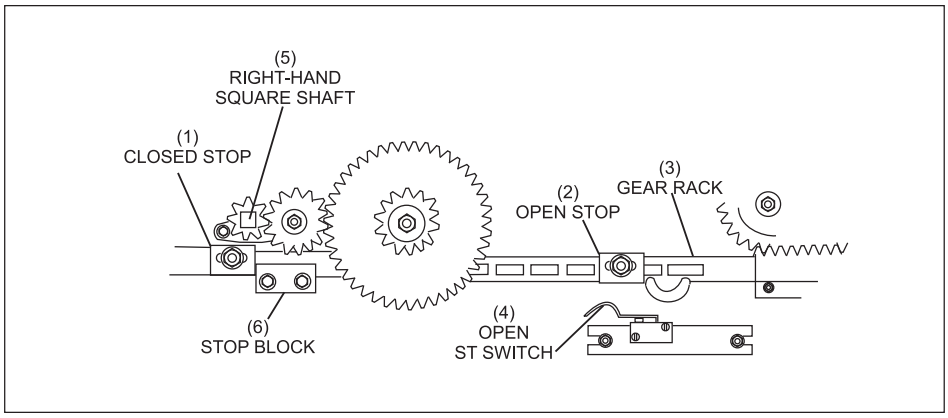

Figure 8-6. Spotting Tongs Closed.

4. Remove the hardware holding the spotting tongs to the setting table. Retain the hardware for use during reassembly.

NOTE: *To keep the tongs timed properly, it is advisable to only remove one set of tongs at a time.*

5. Select the correct type depending on the position of the tongs in the table. Refer to *Figure 8-7*.

(1) SPOTTING TONGS PIN STATIONS 1, 4, 5, AND 6
(2) SPOTTING TONGS PIN STATIONS 2, 3, 7, 8, 9, AND 10

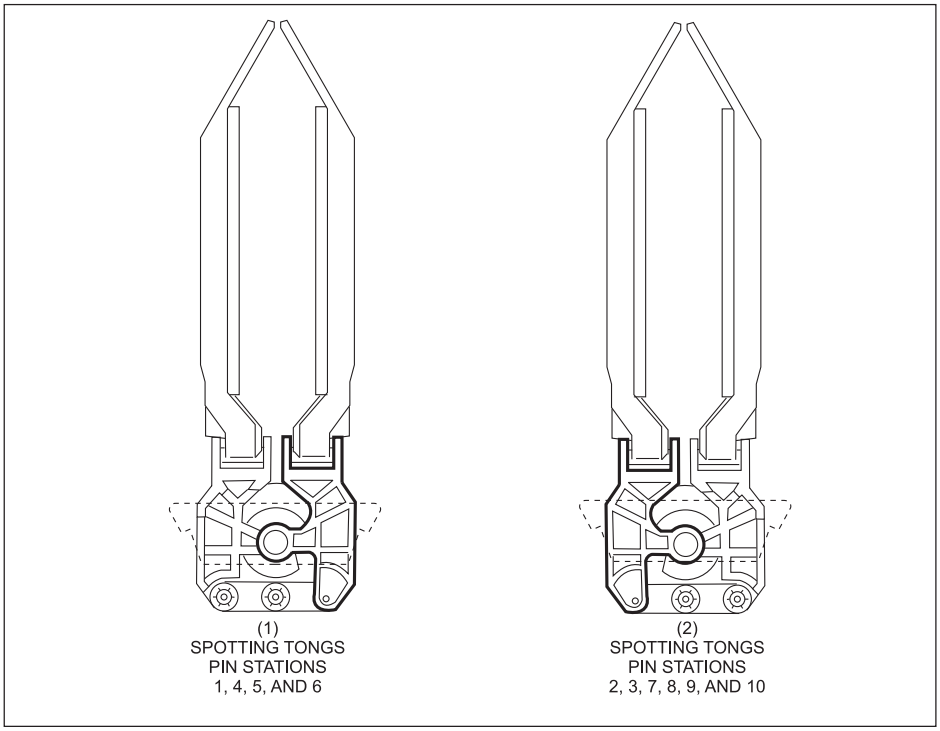

Figure 8-17. Spotting Tongs.

6. Turn the gear on the bottom of the spotting tong assembly until the tongs are completely closed. Refer to *Figure 8-8*.

(1) TURN GEAR TO CLOSE TONGS

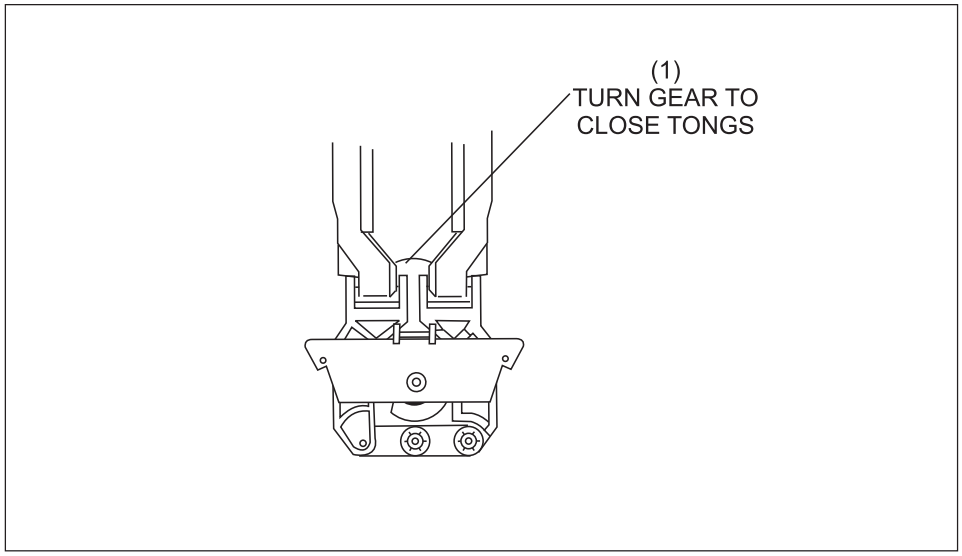

Figure 8-8. Spotting Tongs Completely Closed.

7. Place the closed spotting tongs on the setting table so the gears mesh. Reinstall the mounting hardware through the cover plate and the mounting holes.

8. Manually rotate the square shaft to open and reclose the tongs to check for proper movement.

Spotting Tong Clutch And Shaft Removal Procedure

NOTE: *Disconnect incoming power to the Nexgen Controller before proceeding with the removal of the spotting tong clutch and shaft.*

1. Remove the Torx screws which hold the switch cluster assembly to the pinsetter frame. *Refer to Figure 8-9.*

(1) CLUTCH SHAFT GEAR

(2) TORX SCREWS
(3) SWITCH CLUSTER ASSEMBLY

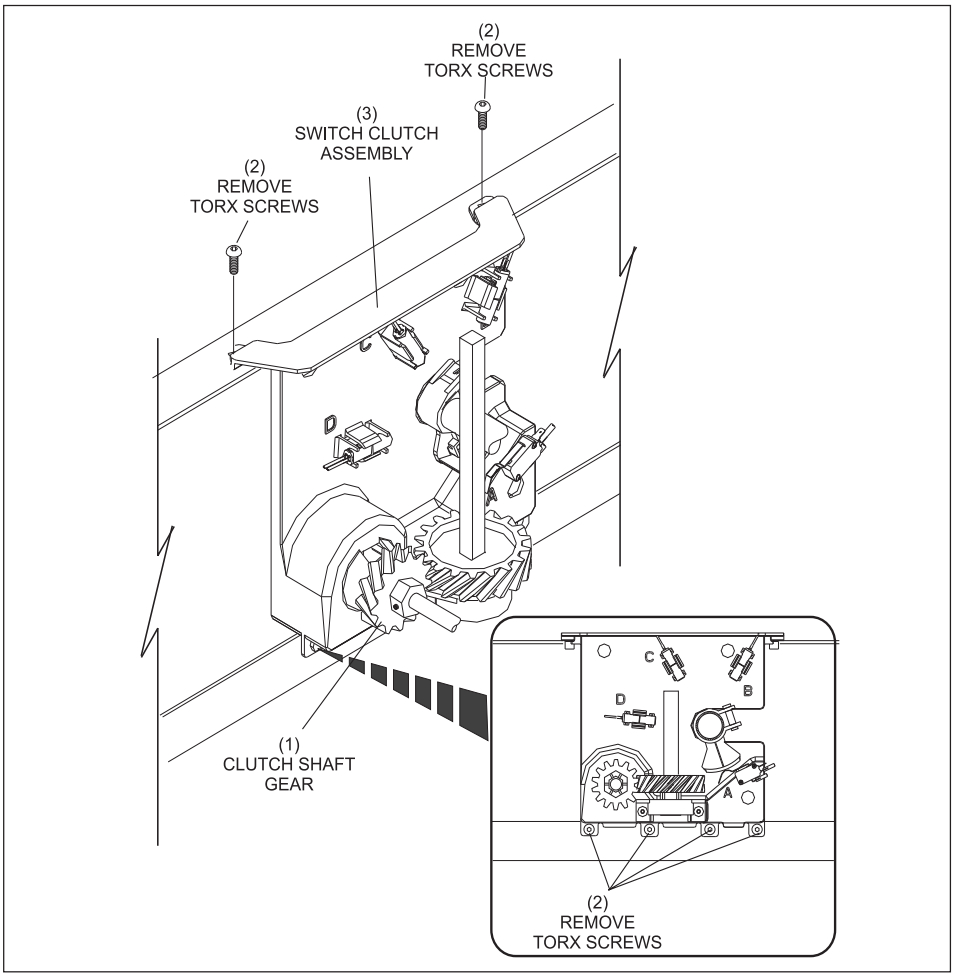

Figure 8-9. Remove Hardware.

2. Disconnect the wires from the “A”, “B”, “C”, and “D” switches. Molex connection can be found in the wire channel above the cluster.

3. Remove the upper section of the spotting tong square shaft.

4. Slide the shaft out and cluster assembly towards the back of the pinsetter and lift it out of the spotting tong solenoid and remove it from the pinsetter.

5. Disassemble the clutch assembly by compressing the clutch spring with the spring tightener and rotating the spring tightener to the open slot. By doing so, the clutch assembly can be disassembled.

6. Clean all the components with a water based cleaner and a dry towel. When reassembling the clutch, position the shiny sides of the two clutch discs to contact the clutch gear. *Figure 8-10.*

(1) SPINDLE SHAFT
(2) CLUTCH DISCS
(3) 3 NOTCHES USED FOR ADJUSTING
(4) SAFETY CLUTCH
(5) CLUTCH GEAR

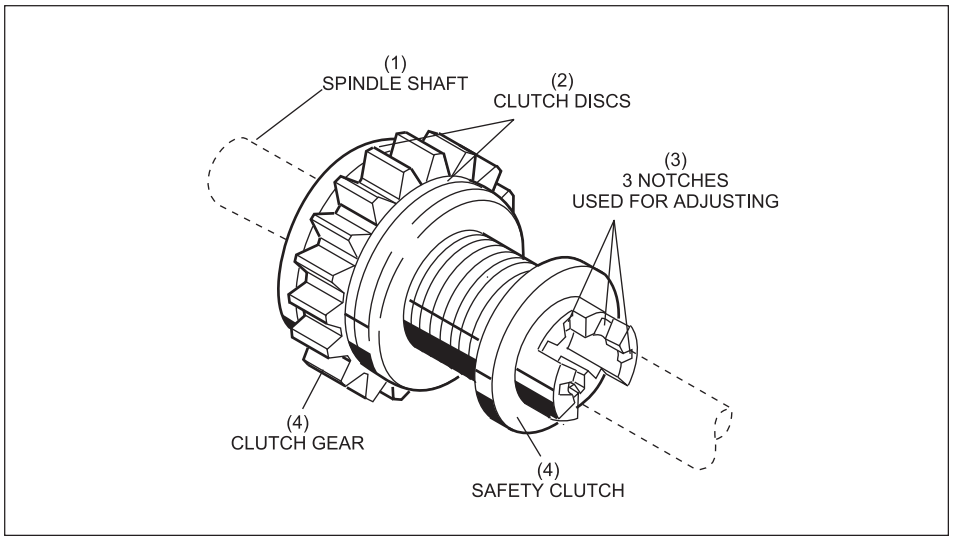

Figure 8-10. Reassembling Clutch.

7. Compress the clutch spring to the original notch position.

Spotting Tong Clutch and Shaft Reinstallation

1. Reinstall the spotting tong clutch and shaft, reversing the removal procedure. One millimeter (1 mm) of side play in the shaft should exist when it is reinstalled to prevent binding in the assembly.

2. To increase the side play, hold the clutch shaft gear and move the shaft toward the switch cluster. To decrease the side play, move the shaft toward the spotting tong clutch. Lock the set screw and verify 1 mm of side play exists.

3. Operate the pinsetter to verify the spotting tong clutch is operating correctly.

Changing Motors

The GS-X Pinsetter uses three different motors. If a motor has to be changed, use the following guidelines.

Motor Removal

1. Turn the stop/run switch on the Nexgen Controller, mechanic's rear control box, or the mechanic's remote display to the stop position. Turn off the main power switch and disconnect the incoming 3 phase power.

2. Unplug the motor from the Nexgen box.

3. Table Motor - if the motor being changed is the table motor, manually lower the table onto a jack stand or all the way down to the new pin setting height. The table chain and crank arm should be in a straight line. Do not lower the table onto the stroke limiter plate; bumping or vibrating the pinsetter may cause it to slip and damage the pinsetter or cause serious injury to the person working on the machine.

4. Lift up against the belt tension spring and remove the "V" belt from the motor pulley.

5. Remove motor support bracket from the left drive frame and lift the motor out of the pinsetter.

6. Remove the motor wire cover plate and disconnect the four wires attached to the terminal block and ground screw.

Motor Pulley

The single pulley used on sweep motor can be used with both 50 and 60 cycle (Hz) power. The table and distributor motors have dual sized pulleys. For 60Hz operation use the smaller pulley, for 50Hz operation use the larger pulley. Using the wrong sized pulley can result in pin handling problems in the distributor or lowering the table too fast/slow, causing pinfall errors and excessive wear on the stroke limiter assembly and setting table.

(1) 60 CYCLE SIDE
(2) 50 CYCLE SIDE

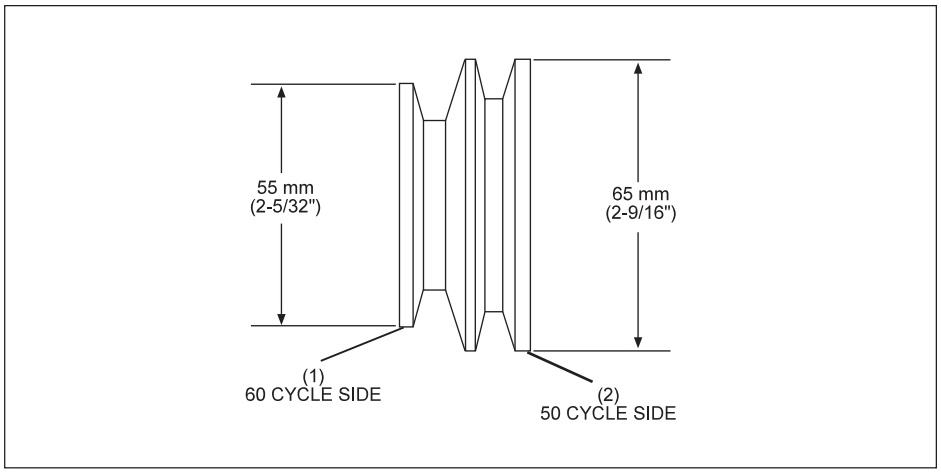

Figure 8-11. Dual Pulley.

Motor Pulley Removal

1. Loosen the pulley's set screw with a 3 mm Allen wrench (hex key).

2. Use a gear puller to slide the pulley off the shaft. Save the key for use during installation.

Motor Pulley Installation

1. Make certain the key is properly seated in the motor shaft.

2. Place the pulley on the shaft with the desired orientation. Tap the pulley onto the shaft with a soft faced hammer.

NOTE: *Some distributor and table motors have a dual pulley. The smaller side is for use when the pinsetter is powered by a 60 cycle (60 hz) supply. The larger size is used when the power supplied is 50 cycles (50 hz). Refer to* Figure 8-16.

3. Align the pulley so that the “V” belt will ride in the center of the motor pulley and the large drive pulley.

4. Tighten the set screw to prevent the motor pulley from moving out of position.

5. Wire the motor for proper voltage input, IE 208, 230, 380.

6. Install the motor onto the pinsetter and wire it for proper voltage. Verify that the wiring straps and Brake PCB (if applicable) are properly attached. Refer to Figures 8-12 and 8-13.

(1) TABLE AND SWEEP MOTOR WIRING FOR 208 TO 230 VOLTS
(2) MOTOR CABLE FROM NEXGEN BOX
(3) GROUND
(4) BRAKE PCB
(5) BRAKE
(6) WIRING STRAPS
(7) MOTOR WIRING BLOCK
(8) GROUND CONNECTION
(9) DISTRIBUTOR MOTOR WIRING FOR 208 TO 230 VOLTS
(10) TABLE AND SWEEP MOTOR WIRING FOR 380 VOLTS
(11) DISTRIBUTOR MOTOR WIRING FOR 380 VOLTS

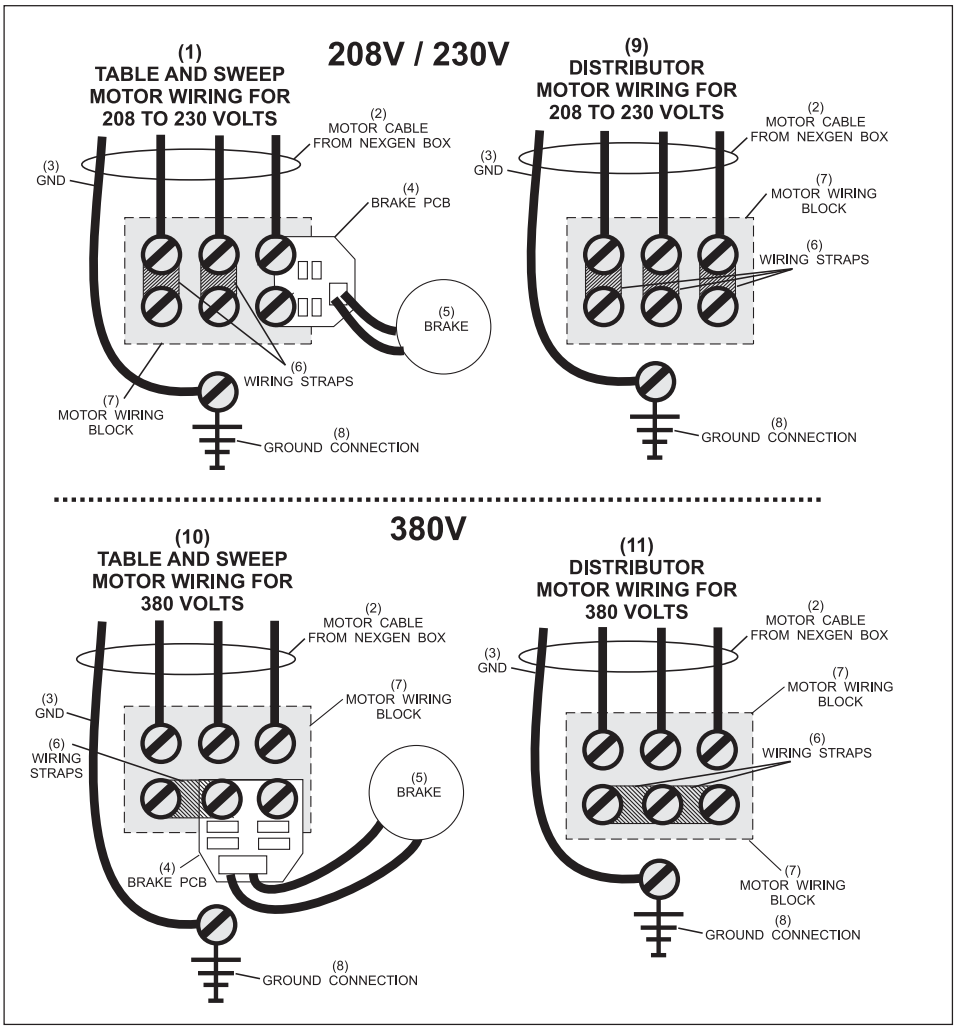
208V / 230V
(1) TABLE AND SWEEP MOTOR WIRING FOR 208 TO 230 VOLTS
(9) DISTRIBUTOR MOTOR WIRING FOR 208 TO 230 VOLTS
380V
(10) TABLE AND SWEEP MOTOR WIRING FOR 380 VOLTS
(11) DISTRIBUTOR MOTOR WIRING FOR 380 VOLTS
(2) MOTOR CABLE FROM NEXGEN BOX
(3) GND
(4) BRAKE PCB
(5) BRAKE
(6) WIRING STRAPS
(7) MOTOR WIRING BLOCK
(8) GROUND CONNECTION

Figure 8-12. Table, Sweep and Distributor Motor Wiring.

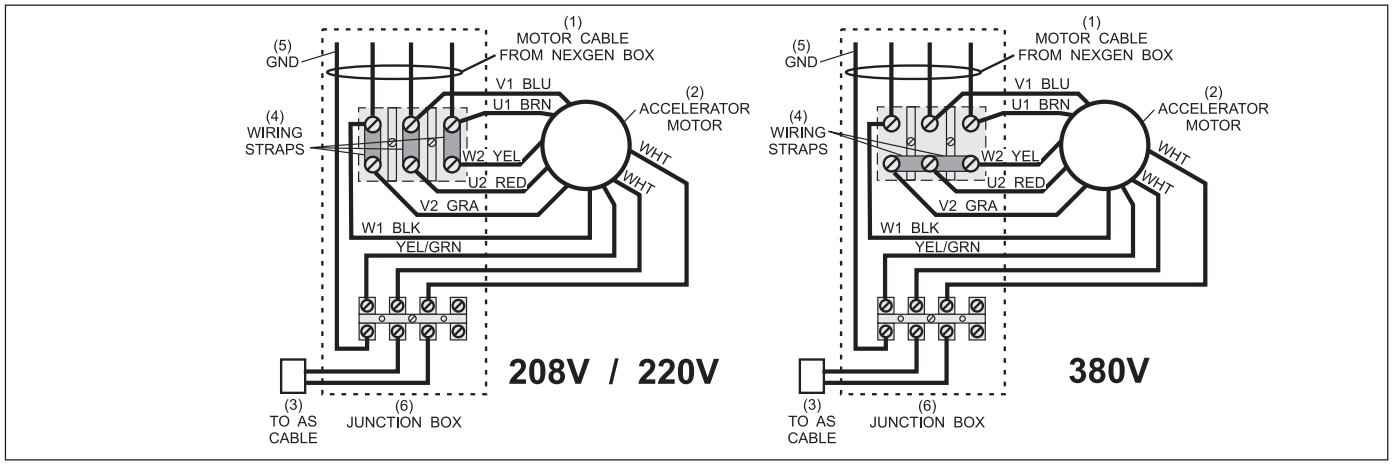

Figure 8-13. Accelerator Motor Wiring.

(1) MOTOR CABLE FROM CABLE
(2) ACCELERATOR MOTOR
(3) TO AUTOMATIC SCORER NEXGEN BOX
(4) WIRING STRAPS
(5) GROUND
(6) JUNCTION BOX

7. Turn the pinsetter on briefly and watch the rotation of the motor for proper direction as noted*.

* Table Motor - Watch the switch cluster cam. It should leave the “A” switch and go to the “B” switch (counter-clockwise) when making a detection stroke. If it is running the wrong direction, you will typically get an error code associated with the switch cluster switches.

* Sweep Motor - Watch the cam on the crank arm on the right side of the pinsetter. It must leave the “SM” switch in the “3 o’clock” position and go toward the “12 o’clock” position (counter-clockwise).

* Distributor Motor - Watch the green pin handling belts. Make sure they move the pins through the distributor in the proper direction. Running in a reverse direction can cause a shovel jam in the elevator.

* Accelerator Motor - Check that the large belt will propel the ball forward.

If a motor is running backward, swap any two of the three supply wires from the Nexgen box at the motor terminal block. This will reverse the direction of the motor shaft.

WARNING: Never swap the ground (earth) wire with one of the supply wires.

Chain Repair or Replacement

The elevator, table lift, sweep lift and motor shaft chains may need repair or replacement. Brunswick offers a repair kit to assist you in the repair of your chain. Consult the Elevator section of your Brunswick Service Parts catalog for ordering this kit.

The elevator chains are different than the other chains. These chains have longer pins that fit into the end of the pit shovel shaft. When repairing or replacing these chains, it is necessary to keep the pins on both chains running evenly to allow the shovels to lift the pin shovel horizontally.

Chain Repair

1. Remove the chain from the pinsetter.

2. Install the chain repair tool in a vise as illustrated in *Figure 8-14*.

3. Place the pin of the link you wish to place over the bottom hole in the repair tool. Tighten the repair tool to push out through the bottom hole.

(1) CHAIN REPAIR TOOL
(2) CHAIN

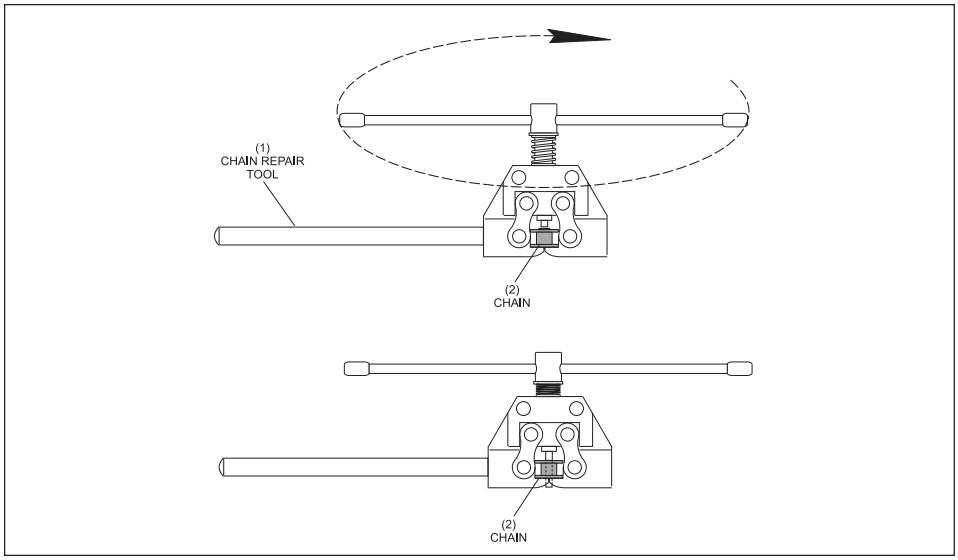

Figure 8-14. Chain Repair Using Vice.

4. Repeat this procedure on the other end of the links to be replaced.

5. Install a master link between the new and old section of chains.

6. Place the cap on both pins of the master link. Refer to *Figure 8-15*.

7. Slide the clip-on spring over the cap and into the notches until both pins are securely locked.

(1) CLIP-ON SPRING
(2) CAP
(3) MASTER LINK

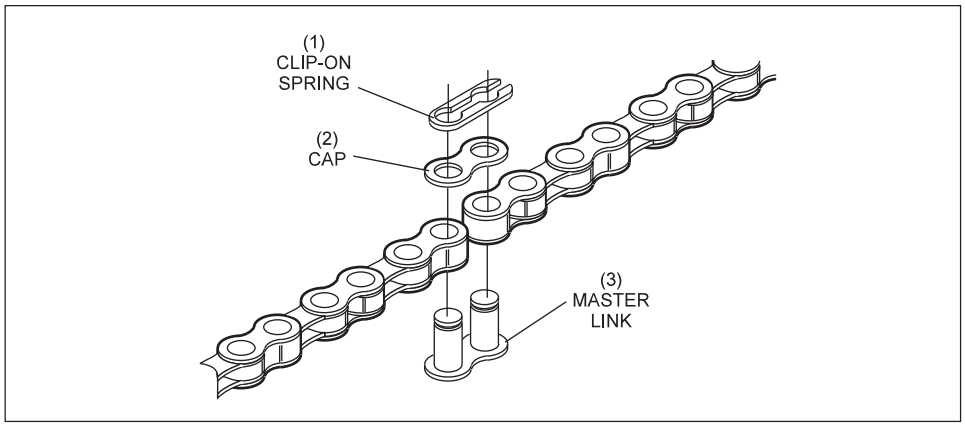

Figure 8-15. Chain Repair.

Chain Replacement

If you are installing a new chain, use a master link to connect both ends of the chain. Use steps 5, 6 and 7 of the Chain Repair procedure.

Adjust the chain for the proper tension or adjustment using the adjustment section of this manual.